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*EUFORA. Allergic Rhinitis Pocket Guide - EUFORA. EUFORA. Published October 13, 2025. <https://www.eufora.org/news/allergic-rhinitis-pocket-guide/>. Last accessed on: 27 November, 2025.

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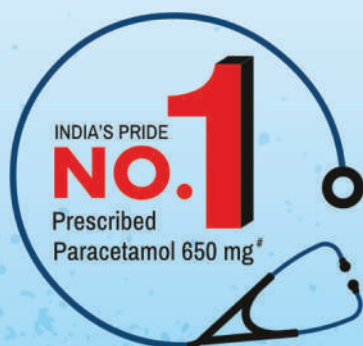
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World No Tobacco Day 2026: Unmask the Appeal—Countering Tobacco and Nicotine Addiction

Ranjan Bhattacharyya

Journal of the Indian Medical Association (2026): 10.5005/jima-11070-0009

World No Tobacco Day is observed every year on May 31, led by the World Health Organization (WHO). The day highlights the health risks linked to tobacco and nicotine use and advocates for effective policies to reduce global consumption. The theme for World No Tobacco Day 2026 is “Unmask the appeal—countering tobacco and nicotine addiction.” This campaign exposes how the tobacco and nicotine industry continues to repackage and rebrand its products—such as e-cigarettes, nicotine pouches, and synthetic nicotine devices—to attract young people while undermining tobacco-control progress.¹

KEY OBJECTIVES

According to WHO's campaign materials, who.int:

- Expose industry strategies that use flavors, sleek packaging, and deceptive marketing to make addiction appealing.
- Strengthen policy actions, such as banning flavors, restricting advertising (especially digital and social media), enforcing plain packaging, and regulating product design.
- Empower youth and the public with knowledge and tools to resist industry influence and support quitting.

Globally, about 40 million adolescents aged 13–15 years use tobacco and 15 million vape. Adolescents are around nine times more likely than adults to use e-cigarettes, highlighting the urgent need for protection and education. The tobacco burden in India is a multifaceted crisis that impacts public health, the national economy, and individual household stability. Recent data from 2024 to 2026 reveals a complex landscape: While the government has made progress toward global reduction targets, specific consumption trends—particularly in rural and urban households—are raising new alarms.²

CONSUMPTION TRENDS (2024–2026)

According to a 2026 working paper by the Economic Advisory Council to the Prime Minister (EAC-PM), there has been a significant surge in tobacco consumption incidence over the last decade:

- Household reach: Tobacco-consuming households in rural India rose from 59.3 to 68.6%, and in urban India from 34.9 to 45.6%.

Launched in 2007–2008, the National Tobacco Control Programme (NTCP) is India's primary administrative framework for implementing tobacco control laws and reducing prevalence. As of 2026, the program has scaled to nearly all districts in India, focusing on a “whole-of-government” approach to meet the WHO Framework Convention on Tobacco Control (FCTC) targets.³

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THREE-TIER STRUCTURE

The NTCP operates through a decentralized hierarchy to ensure national policies reach the grassroots:

- National level [National Tobacco Control Cell (NTCC)]: Based in the Ministry of Health and Family Welfare (MoHFW), it handles policy formulation, national mass media campaigns, and monitoring.
- State level [State Tobacco Control Cell (STCC)]: Dedicated cells in each state that coordinate district activities and conduct advocacy workshops for state-specific enforcement.
- District level [District Tobacco Control Cell (DTCC)]: The “action” arm responsible for local enforcement, training of police and teachers, and managing school-based programs.

Key Components and Interventions

The program is built around several functional pillars designed to shift social behavior and restrict access:

- Cigarettes and Other Tobacco Products Act (COTPA) enforcement: Ensuring compliance with the COTPA (2003), which bans public smoking (Section 4), direct/indirect advertising (Section 5), and sales to minors or near schools (Section 6).
- Yellow line campaign: A high-visibility initiative where a yellow line is painted 100 yards around educational institutions to mark a “Tobacco-Free Zone.”
- Rose campaign: A soft-enforcement tactic where children and volunteers offer roses to tobacco vendors to sensitize them about the harmful effects of selling to youth.
- Cessation services:
 - National Quitline: A toll-free helpline (1800-112-356) providing counseling in multiple regional languages.
 - m-Cessation: A text-message-based support system (reached by giving a missed call to 011-22901701).

Recent Developments (2024–2026)

- **Digital integration:** The 2026 National Conference on Tobacco or Health (NCTOH) highlighted the shift toward using artificial intelligence (AI)-assisted chatbots and the e-Sanjeevani telemedicine platform to deliver cessation counseling to remote areas.
- **Tobacco-free film rules:** Updated regulations in 2024–2025 have intensified requirements for antitobacco warnings on streaming (OTT) platforms.
- **Vendor licensing:** There is a growing push to mandate specific licenses for tobacco vendors, making it easier to revoke the right to sell if COTPA rules are violated.
- **Bidi Tax Advocacy:** Recent policy briefs (May 2026) have urged the government to remove tax exemptions for the bidi industry, which remains a massive part of the rural tobacco burden.

Current Status and Success

India is currently on track to reach a 43% relative reduction in tobacco use by 2025–2026 compared to 2010 levels. However, experts at the 2026 World No Tobacco Day summits warned that while cigarette use is dipping, the smokeless tobacco (gutkha/khaini) and e-cigarette (vaping) markets—the latter of which is banned but still active via informal channels—remain the program's toughest challenges.⁴

The Cigarettes and Other Tobacco Products Act (2003) is the cornerstone of tobacco regulation in India. It is a comprehensive law designed to protect public health by restricting the advertising, trade, and consumption of tobacco.

As of 2026, COTPA has been further strengthened by major amendments to the taxation and enforcement landscape.⁵

KEY SECTIONS OF THE ACT

The Act is built around four primary prohibitive sections that form the basis of tobacco control in India:

Section	Provision	Description
Section 4	No smoking in public	Bans smoking in all public places (hospitals, schools, offices, restaurants, public transport). Establishments with 30+ rooms or seats may have a designated smoking area
Section 5	Advertising ban	Prohibits direct and indirect (surrogate) advertising of tobacco products via media, Internet, or social media. Banned: Brand names on gifts, prizes, or event sponsorships
Section 6(a)	Minors protection	Prohibits the sale of tobacco products to anyone under 18 years of age
Section 6(b)	School buffer zones	Bans tobacco sales within 100 yards of any educational institution (marked by the "Yellow Line")
Section 7	Pictorial warnings	Mandates specific health warnings (e.g., "Tobacco Causes Mouth Cancer") and images covering at least 85% of the package area

Significant 2026 Updates

The landscape changed significantly on February 1, 2026, with a major overhaul of how these products are taxed and regulated:

- **Retail sale price (RSP)-based goods and services tax (GST):** Taxation is no longer based on the transaction value but on the

RSP printed on the package. This prevents manufacturers from underreporting values to save on tax.

- **Tax rate hike:** Most tobacco products (cigarettes, gutkha, and pan masala) now attract a 40% GST rate.
- **Bidi adjustment:** In a major policy shift, the GST on bidis was reduced to 18%, but it is now paired with a new 10% excise duty to maintain the health-tax balance.
- **Illicit trade (Section 10A):** A new section was inserted specifically targeting "illicit" tobacco, giving authorities greater power to track, trace, and seize products that bypass standard labeling and tax regulations.

Penalties and Enforcement

Violations of COTPA can lead to significant consequences:

- **Public smoking:** On-the-spot fines of up to ₹200 (proposed to be raised to ₹2,000 in recent amendment bills).
- **Illegal advertising:** First conviction can lead to up to 2 years in prison and a fine of ₹1,000.
- **Sale to minors:** Recent updates have pushed for stricter imprisonment for vendors repeatedly caught selling to children.

Scope

The Act covers all forms of tobacco listed in its schedule, including:

- **Smokeless:** Gutkha, khaini, mawa, mishri, and snuff.
- **Smoking:** Cigarettes, bidis, cigars, and hookah tobacco.
- **E-cigarettes:** Note that while COTPA regulates traditional tobacco, the PECA Act (2019) provides a complete ban on the production, sale, and advertisement of electronic cigarettes.

Here is a comprehensive guide based on the theme "Unmask the Appeal," designed to break down the deceptive allure of tobacco and nicotine and provide actionable strategies for counteracting addiction.⁶

Addiction to tobacco and nicotine is rarely just a "bad habit"; it is a carefully engineered trap. To break free, we must first pull back the curtain and understand "why" these products are so appealing—and why that appeal is an illusion. The tobacco industry spends billions to mask the reality of its products with glamour, relief, and social acceptance. To counter the addiction, you must first see through the masks. Nicotine creates a sensation of alertness, relaxation, or pleasure. It feels like a reward. Nicotine hijacks the brain's reward system. It causes a rapid release of dopamine, but the effect is fleeting. Once the nicotine wears off, dopamine levels drop below baseline. What users perceive as "stress relief" is actually the temporary cessation of withdrawal symptoms induced by the drug itself. You are not smoking to feel good; you are smoking to feel "normal." Smoking or vaping is marketed as a way to handle stress, anxiety, boredom, or loneliness. It is painted as a "friend" in tough times. Nicotine actually increases physiological markers of stress (higher heart rate, constricted blood vessels). Relying on a substance to regulate emotions erodes the brain's natural ability to cope with stress. It creates a cycle of dependency where the user feels unable to navigate life without a chemical crutch.⁷

Historically linked to rebellion, coolness, or sophistication (and now to modern tech and flavors in vaping). It signals being part of a group. The social cost of addiction is isolation. The smell, the need to step away, the health decline, and the financial drain often separate users from the very people they want to connect with. True belonging does not require a chemical contract.⁸ The cigarette with coffee, the vape after a meal, the dip while driving. These feel

like satisfying pauses in the day. These are Pavlovian conditioning triggers. The brain has wired the activity (coffee, driving) to the drug. The “appeal” is simply a deeply grooved neurological pathway that can be rewired—not a genuine enjoyment of the product. Quitting is a battle against both biology (withdrawal) and psychology (habit).⁹

Nicotine replacement therapy (NRT): Patches, gum, and lozenges deliver slow, clean nicotine without the tar and toxic chemicals of smoke. They wean the brain off the drug gradually, reducing withdrawal severity. Drugs such as varenicline or bupropion block nicotine receptors in the brain, making smoking less enjoyable and reducing cravings.¹⁰

COGNITIVE BEHAVIORAL TACTICS

The “5 Ds” of craving management are as follows:

1. Delay: Wait 5–10 minutes. The urge usually passes on its own.
2. Distract: Do something else immediately (push-ups, sudoku, call a friend).
3. Drink water: Sip water slowly to reset the physical sensation in the throat.
4. Deep breathe: Simulate the relaxation aspect of smoking without the toxin.
5. Discuss: Talk to a support person.

ENVIRONMENTAL ENGINEERING

- Strip the environment: Throw away all ashtrays, packs, and vaping devices. Wash clothes and clean the car to remove the scent cues.
- Disrupt the ritual: If you always smoke with coffee, switch to tea for 2 weeks. If you smoke in the car, take a different route to work. Break the associations.
- “Flip the script” on thinking: When a craving hits, the addicted brain creates “euphoric recall” (remembering only the good parts). Counter this immediately with the truth.¹¹

To counter tobacco and nicotine addiction, we must stop viewing it as a pleasure we are giving up and start viewing it as a shackle we are throwing off. By “unmasking the appeal”—seeing it as a

biological trap rather than a lifestyle choice—we strip the product of its power and reclaim our freedom.

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Epidemiology of the Traumatic Spine Fracture in South Indian Population

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ABSTRACT

Background: To study the demographics and impact of gender, age, and the type and distribution of traumatic spine fractures, as well as the possibility of suffering neurological deficit or an associated injury in the South Indian population, and to suggest, if possible, safety and precautionary measures to minimize the impact of the injury.

Materials and methods: Retrospective evaluation of 190 patients with traumatic spine fractures based on medical records. The original radiographs, magnetic resonance imaging/computed tomography (MRI/CT) scans, and medical records for each patient were examined.

Setting: Level 1 trauma center from 01/2019 to 05/2022.

Results: The major cause of injury was observed to be falls from height, with about 73.7% of patients reporting it as the main reason for injury, followed by 21.2% who cited road traffic accidents as the reason. Of the 190 patients in this group, 64.7% had no associated neurological deficits. Fractures occurred most frequently in the L1 vertebra (28.42%) and L2 vertebra (17.19%).

Conclusion: The necessity to educate people involved in professional tree-climbing activities to use protective gear, such as tree-climbing carabiners, climbing harnesses, helmets, slings, prusiks, and other necessary equipment. To provide demographic data for the healthcare authorities to plan/develop effective prehospital and specialized healthcare services according to the regional needs.

Keywords: AO Classification, Associated injury, Neurological deficits, Spinal cord injury, Spine fracture, Trauma.

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INTRODUCTION

Traumatic spinal injuries account for only 20/million of all trauma patients in India, but the impact of spinal injuries on the patient's social, financial, and psychological well-being is frequently greater than that of other injuries. These injuries can cause damage to the nerve roots, spinal cord, disco-ligamentous elements, and osseous structures of the spinal column and are included in traumatic spinal injury (TSI). Injuries can be the consequence of both low-energy and high-energy causes, and they can be subsequent to blunt or penetrating trauma. Damage to the nervous system typically causes paresis or full paralysis, whereas spinal column damage can cause mechanical instability, discomfort, and decreased mobility. TSI has the potential to result in serious disability or even death. The estimate of the worldwide burden of TSI is still hampered by the lack of data, particularly from low- and middle-income countries (LMICs).

According to a study by Leucht et al.¹ on 562 German patients, there are correlations between age, gender, and accident cause and the type and distribution of spinal fractures, neurological deficiency, or an associated injury. Accidental falls appeared as the major contributor to traumatic spinal fractures in this investigation, according to an observational study by Wang et al.,² and the frequency of fall-related and sports-related injuries rose gradually with age. In their study of 1,138 individuals with severe spinal cord injuries, Chhabra and Arora³ found that India's spinal cord injury demographics were very different from those of affluent nations. A prospective cohort research study was conducted by Waheed et al.⁴ on patients from 14 trauma centers in India. They came to the conclusion that receiving treatment through the public healthcare system, having a more severe injury, and undergoing surgery were all linked to a higher risk of serious sequelae after spinal injuries.

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Young males are most frequently injured in traumatic spine fractures, and domestic falls are the most prevalent cause of these injuries, according to Kumar et al.⁵

Agarwal et al.⁶ conducted a retrospective analysis in which 207 individuals with nontraumatic and traumatic spinal injuries were included. Of the 207 patients with spinal injuries, 74.4% had conservative management, whereas 25.6% received surgical treatment. According to Gupta and El Masri,⁷ neurological lesions were incomplete in more than half of the patients and occurred at several levels in 9.7% of the cases. In 2002, in the United Kingdom, Robertson et al.⁸ conducted an analysis of the records of 2,718 car occupants and 1,121 motorcycle riders involved in automotive trauma. A total of 383 (14.1%) automobile passengers and 126 (11.2%) motorcycle riders had spinal injuries.

There may be different spinal injury patterns due to the significant variations in the prevalence of the numerous traumatic injury mechanisms between industrialized and developing nations. There may also be some differences in the distributions, correlations, and incidence of spinal fractures in different populations under different circumstances. Therefore, these regional epidemiological data on spine fractures can help design specific preventive strategies for spine fractures. Also, they can help identify provocative factors that could prevent injury if avoided. This study provides an overview of demography, completeness of injury, level of injury, prevalence, incidence, and mechanisms of injury from traumatic spinal cord injury in the coastal belt of South India.

AIMS AND OBJECTIVES

- To study the epidemiology of traumatic spine fractures.
- To describe the influence of gender, age, and cause of injury on the fracture type and its anatomical distribution.
- To identify the pattern of fracture with mechanism of injury, associated injuries, neurological deficits, and length of hospital stay.

Inclusion Criteria

- Inpatients with traumatic spine fractures (as per AO fracture classification).
- Patients with or without neurological deficits (as per ASIA scale).
- Age >18 years.

Exclusion Criteria

- Pathologic spine fractures.
- Old fracture with deformity.

METHODOLOGY AND PROCEDURE

The data of 190 patients who were admitted from January 2019 to May 2022 with traumatic spine fractures, with or without associated injuries as well as neurological deficits, were collected. Patient consent was obtained. The classification of fracture was based on plain radiographs in two views and MRI scans, with or without CT scan, according to the AO classification. The neurological status assessment was done according to AIS (ASIA Impairment Scale) based on clinical data (prospectively) and hospital records (retrospectively).

All these data were analyzed and recorded in Microsoft Word 2013 and Microsoft Excel, and statistical analysis was done using SPSS software. All assessments were made by a single observer. As this was an observational data (case record)-based study, no human interventional procedure was done; hence, institutional review board approval was not required.

RESULTS AND OBSERVATIONS

In the distribution of gender, there were 171 males and 19 females, for a total of 190 patients (Table 1). It was found that 90% of patients were males, and most of the participants were in the 31–60 years age-group. It was observed that the majority of male patients were in the 41–50 years age-group, followed by the 51–60 years age-group, whereas most of the female patients were in the 51–60 years age-group (Table 2). Regarding the cause of injury, about 73.7% of patients reported falls from height as the main reason for injury, followed by 21.2% who cited road traffic accidents as the reason.

Table 1: Distribution of gender

	Males		Females		Total	
	N	%	N	%	N	%
Gender	171	90	19	10	190	100

Table 2: Patient distribution by age and gender

	Males		Females	
	N	%	N	%
<20 years	8	66.7	4	33.3
21–30 years	23	88.5	3	11.5
31–40 years	38	97.4	1	2.6
41–50 years	46	95.8	2	4.2
51–60 years	42	84	8	16
61–70 years	12	92.3	1	7.7
>70 years	2	100	0	0
Total	171	90	19	10

About 66.8% (127 patients) of injuries involved a single segment, followed by 26.8% (51 patients) involving two-segment contiguous fractures, which were most commonly observed at the thoracolumbar junction and lumbar spine (Fig. 1).

Out of 51 two-segment fractures, 13 patients had contiguous vertebral fractures. Of the five patients with three-segment injuries, three had contiguous vertebral fractures. Out of the 16 patients with contiguous vertebral fractures, 11 resulted from falls from height.

AO Fracture Classification

About 32.8% of fractures were of the A0 type, followed by 26.22% that were A3 type and 23.55% that were A1 type. B2 had the highest frequency among type B fractures, and 10.66% constituted the C type of fracture (Fig. 2).

Neurological Deficits

Out of 190 patients, 64.7% did not have any associated neurological deficits. Complete spinal cord injury (AIS A) was the most frequently associated neurological deficit (16.8%), followed by AIS C at 7.9%. A total of 1% of patients had single-limb radiculopathy (Fig. 3).

Age Distribution

It was observed that A, A2, and A4 types of fractures were more common in older participants in the 51–60 years age-group, whereas B3 type fractures were observed in younger participants aged <20 years. B1 fractures were found more commonly among participants aged 31–40 years.

Reason for Injury and Type of Fracture

It was found that the majority of fracture types were due to falls from height, whereas about 75% of B3 and 50% of A2 type fractures resulted from road traffic accidents.

Associated Injuries

It was observed that the lower limb was affected in about 17.4% of participants, followed by the chest and upper limbs, which were observed in 7.4 and 6.3% of participants, respectively. It was found that the most frequent cause of injury was RTA in almost all age-groups except for patients above 70 years. This was followed by falls from

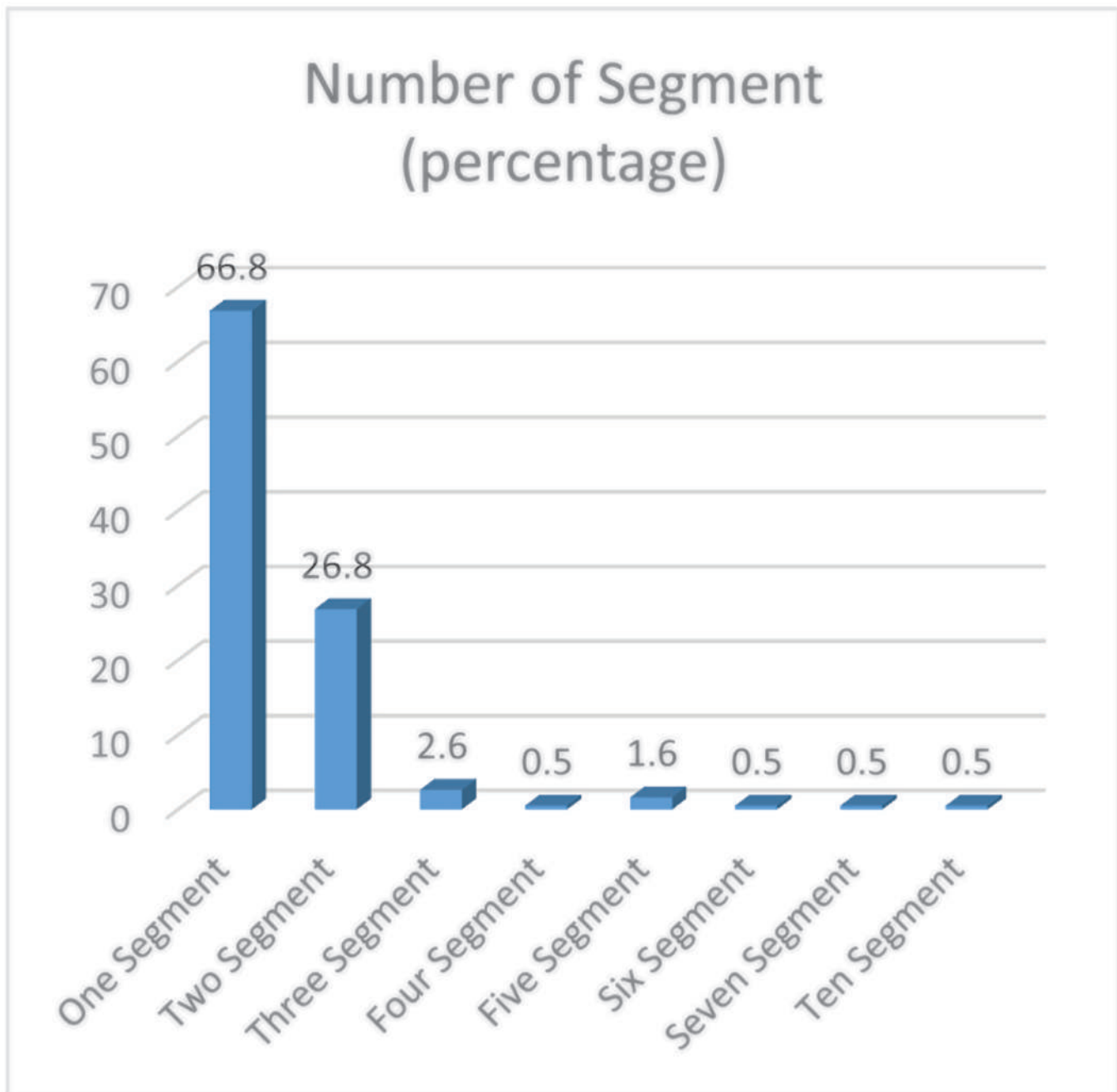


Fig. 1: Number of segments

height, which involved almost all age-groups. It was observed that 36 patients and 40 patients reported falls from height as the reason for injury in the 31–40 years and 51–60 years age-groups, respectively.

Level of the Fracture

The fracture level that occurred most frequently was at the L1 vertebra (28.42%), followed by the L2 vertebra (17.19%).

DISCUSSION

Understanding the epidemiological characteristics of spine fractures from C1 to L5 was the primary objective of this research. In order to avoid statistical bias, we included patients of both genders in all age-groups. While it was our objective to offer an

impartial and comprehensive perspective without excluding any populations or fracture types, assessment of the entire study group showed that 90% of the patients with vertebral fractures were male, as previously reported.⁹

In our research, the male-to-female ratio (9:1) was significantly greater than the global average (3.8:1) and several domestic studies.¹⁰ Due to India's low ratio of female professionals and technical employees (20.5%), Indian women have a decreased propensity for traumatic spine fractures.¹¹ However, as seen in industrialized nations, with more women driving cars, the incidence among women is projected to rise over time.

Our study revealed that high-energy trauma was more likely to occur in men than in women as a result of their occupations or leisure activities, as well as a significantly higher proportion of

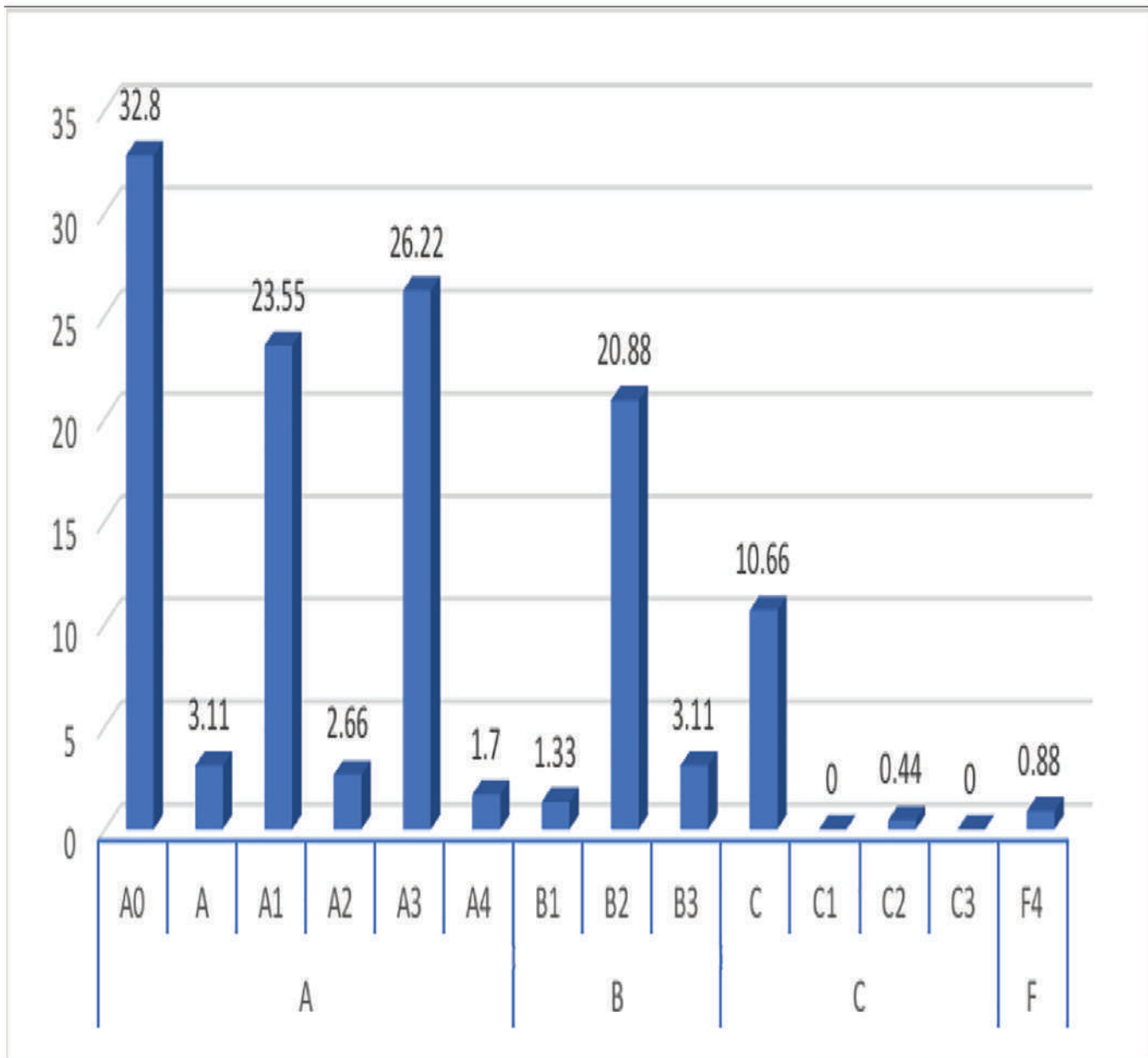


Fig. 2: Type of fracture

male drivers. We observed that the majority of women had type A fractures, which are caused by low-energy trauma.

In our study, falls from height were the most frequent mode of injury, and RTAs were the 2nd most frequent. This finding contrasts with studies from Western nations⁷ but is consistent with the majority of other studies from India.^{6,10} The disparate findings of other Indian pilot studies could be more a result of regional variation. The study by Chacko et al.¹⁰ found that falls from trees were the most frequent reason for accidents.

Previous investigations showed that the thoracic spine and cervicothoracic junction were primarily impacted by traffic accidents.^{12–14} This was an intriguing finding since it suggested that, even while the thoracic spine is adequately protected by the robust rib cage, traffic accidents might still exert significant stress on it. Previous research indicated that high-energy trauma mechanisms, such as falls (21–41%) and car accidents (41–65%), were the leading causes of thoracolumbar fractures.^{15,16} Our

data showed that there was no specific association between the mechanism and cervicothoracic and thoracolumbar fractures. The cause of the majority of fractures was falls from height (73.7%/140 patients), among which 55% (77 patients) of fractures were at the thoracolumbar junction involving T12 and L1, and only two patients had fractures at the cervicothoracic junction (C7 and T1). Among 40 patients with RTA, 25 sustained injuries to the thoracolumbar junction, and no fractures occurred at the cervicothoracic vertebrae.

In this research population, associated injuries were frequently observed. Extremity, thoracic, and pelvic injuries were the most prevalent related injuries. In our study, out of 99 patients having associated injuries, the upper limb was involved in 21 patients, the lower limb in 44 patients, associated pelvic injuries were seen in 12 patients, and chest injuries were seen in 23 patients. Among lower limb injuries, calcaneal fractures were the most commonly observed (24 patients). It was interesting

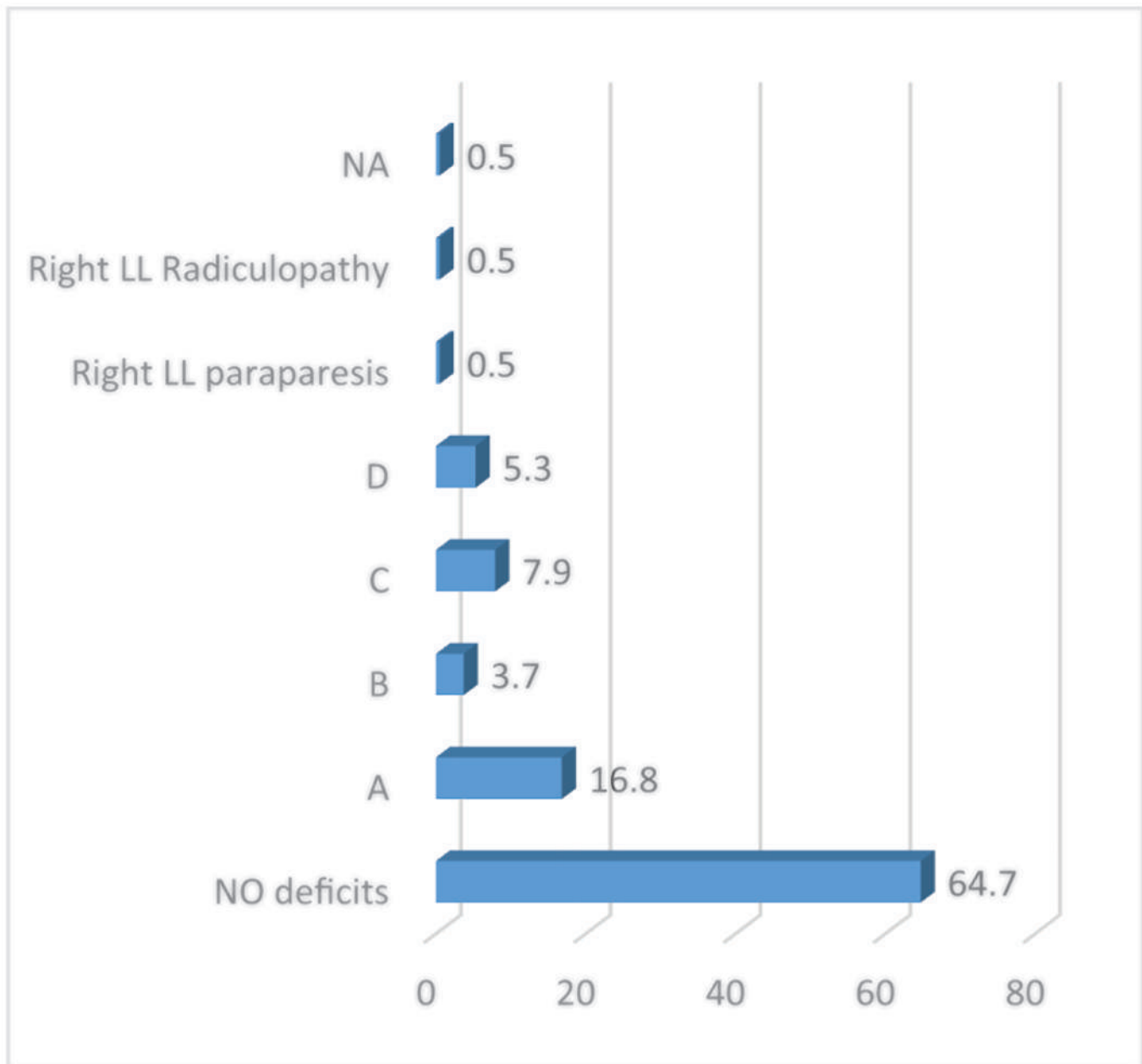


Fig. 3: Neurological deficits according to AIS

in our data that, out of 63 patients with neurological deficits, only 22 had other associated injuries. L1 vertebral fracture was the most common (29 patients) in patients with associated injuries. Associated injuries were seen in 47.5% of the patients with RTA (19 out of 40) and in 42.1% of the patients with falls from height (59 out of 140).

Our data revealed no association between neurological deficits and associated injuries, which was most likely caused by the rise in high-energy trauma.

The average length of hospital stay was observed to be 10.26 days after sustaining spine fractures. The average hospital stay of patients without associated injuries was 7.45 days, whereas the hospital stay of patients with associated injuries was 12.17 days, which was due to concomitant surgeries for associated injuries, as well as delay or modification in rehabilitation/mobilization.

Patients with fractures of the lumbar, cervical, or thoracic spine spent an average of 10.58 days, 10.38 days, and 9.75 days in the hospital, respectively.

The most evident restriction of our work's retrospective component is that it depends on the accuracy of the information recorded in the patients' medical records.¹⁷⁻²⁰

CONCLUSION

This research reveals that the prevalence of spinal cord injuries in India is significantly different from that in other affluent countries, and there are many regional differences within the nation as well. Complete spinal cord injuries, people who have fallen from height, and RTAs involving two wheelers all have a substantially higher percentage of male victims. Falls from height were the most frequent

cause of injury in our investigation, which is consistent with other published studies from the nation. There is a need to educate people involved in tree/building-climbing activities regarding safety and the use of protective equipment, such as helmets, tree branch savers, tree-climbing carabiners, climbing harnesses, slings, prusiks, and other devices. These data are also useful for healthcare authorities to plan/develop effective prehospital and specialized healthcare services according to regional needs. A large multicentric investigation is required to validate the study findings and/or provide more information to aid in the development of preventive initiatives.

TAKE-HOME MESSAGE

Overall, our study offers data that shed light on the demography of traumatic spine fractures in our region. It would be beneficial to have data from the entire area as well. Studying prehospital care and survival rates would also be helpful. We can suggest the use of special personal protective devices that can prevent or minimize the impact of injury in people who are professionally involved in tree/building-climbing activities.

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A Study of Demographic Data and Treatment Outcome in Extrapulmonary Tuberculosis Cases at Tertiary Care Hospital: Observational Retrospective Cohort

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ABSTRACT

Background: Extrapulmonary Tuberculosis (EPTB) describes the various conditions caused by Mycobacterium Tuberculosis infection of organs or tissues outside the lungs. There are many forms of EPTB, affecting every organ system in the body. The burden of EPTB is high ranging from 15–20% of all TB cases in HIV-negative patients, while in HIV-positive people, it accounts for 40–50% of new TB cases.

Materials and methods: The study was done at PDU Government Medical College Rajkot, Gujarat, India. A retrospective analysis of data of EPTB patients register from January, 2022 to July, 2023 covered. The diagnosis of EPTB was based on the following criteria: Suggestive clinical features, Positive microbiological or histopathological evidence of M. TB from an EP site, Radiological changes consistent with EPTB, A satisfactory response to ATT. A patient diagnosed with both pulmonary and extrapulmonary TB was classified as pulmonary TB and was excluded from the study. Investigations included FNAC for lymph node, FNAC and histopathology for skin, genitourinary and breast tuberculosis, X-ray for bone tuberculosis, synovial biopsy for joint tuberculosis, CSF cytology and biochemistry for tuberculous meningitis, CECT or MRI of brain, MRI of spine and pleural fluid study for tuberculous pleural effusion.

Treatment outcome: In this study out of total 744 EPTB cases 669(89.91%) patients declared cured, 23(3.09%) patients declared treatment failure, 7(0.94%) patients lost to follow up, 45(6.05%) patients died during treatment. Lymph node TB out of total 270 cases 57(21%) cases need extension of duration of treatment. Out of total 45 patients died most were from pleural 21(46.67%) and CNS 12(26.67%) TB patients.

Discussion: The study was done to know the demographic and treatment outcomes of various EPTB patients in this study. Firstly, males (61.96%) and females (38.04%) contributed to male patients more than female number of cases overall. The majority of cases (59.28%) belonged to the age group of 15–42 years, who are young and working individuals, highlighting the socio-economic burden of EPTB. In this study overall incidence of EPTB site wise are Lymphnode(36.7%), pleural(29.84%), CNS(14.78%), Abdominal(11.28%), Bone & joint (5.37%), Cutaneous(0.40%), genito urinary(0.13%) seen in our study.

Conclusion: The burden of EPTB is more among the productive age group. The difference in the occurrence of various types of EPTB cases in different age groups and sexes without the declining trend highlights the importance of strengthening the services for this vulnerable group.

Keywords: Demographic data, Extrapulmonary TB, HIV reactive, Productive age group, Treatment outcome.

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INTRODUCTION

Extrapulmonary tuberculosis (EPTB) is frequently a diagnostic and therapeutic challenge. It is a common opportunistic infection in people living with human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) and other immunocompromised states, such as diabetes mellitus and malnutrition. There is a paucity of data from clinical trials in EPTB, and most of the information regarding diagnosis and management is extrapolated from pulmonary TB.^{1,2}

Extrapulmonary tuberculosis describes the various conditions caused by *Mycobacterium tuberculosis* infection of organs or tissues outside the lungs. There are many forms of EPTB, affecting every organ system in the body. Some forms, such as TB meningitis and TB pericarditis, are life-threatening, while others, such as pleural TB and spinal TB, can cause significant ill health and lasting disability. The burden of EPTB is high, ranging from 15 to 20% of all TB cases in HIV-negative patients, while in HIV-positive people, it accounts for 40–50% of new TB cases.^{1,2} The incidence of TB in India was 2.42 million cases in 2022, around 24% of which were new EPTB cases, equating to 5,80,800 people with EPTB.³

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Most of the resources for research, diagnosis, and treatment are aimed at pulmonary TB, as this form is most common and also most important with regard to TB control and public health. However, EPTB in all its forms has a significant impact on people suffering from the disease, their families, the economy, and the health system. Diagnosis can be difficult, and delay can cause harm, but most people with EPTB can be cured if they have access to diagnosis and treatment with anti-TB drugs in time.^{1,2}

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MATERIALS AND METHODS

The study was conducted at PDU Government Medical College, Rajkot, Gujarat, India. An observational retrospective analysis of data of EPTB patients registered under NIKSHAY software from January 2022 to July 2023 was covered. In this study, a total of 744 EPTB patients were covered who were diagnosed during this period and whose treatment outcomes were available.

Source of Information and Definitions

The sources of information were the TB register and patient record sheets. In all cases of EPTB, sputum examinations and chest radiographs were used to investigate the involvement of lung parenchyma. The diagnosis of EPTB was based on the following criteria: (1) Suggestive clinical features, (2) positive microbiological or histopathological evidence of *M. tuberculosis* from an extrapulmonary site, (3) radiological changes consistent with EPTB followed by the decision of the treating doctor to treat with a full course of anti-TB therapy, and (4) a satisfactory response to antituberculosis therapy.⁴

Extrapulmonary TB is defined as TB of any organ other than the lungs, such as the pleura (TB pleurisy), peripheral lymph nodes, intestines, genitourinary tract, skin, joints and bones, meninges of the brain, etc. Investigations included fine-needle aspiration

cytology (FNAC) for lymph nodes; FNAC and histopathology for skin, genitourinary, and breast tuberculosis; X-ray for bone tuberculosis; synovial biopsy for joint tuberculosis; cerebrospinal fluid (CSF) cytology and biochemistry for tuberculous meningitis; contrast-enhanced computed tomography (CT) or magnetic resonance imaging (MRI) of the brain; MRI of the spine; and pleural fluid study for tuberculous pleural effusion.⁴

Inclusion Criteria

This study includes all EPTB cases diagnosed and treated at our center, with all age-groups including both male and female patients.

Exclusion Criteria

A patient diagnosed with both pulmonary and EPTB was classified as pulmonary TB and was excluded from the study.

RESULTS

In this study, out of a total of 744 EPTB cases, 669 (89.91%) patients were declared cured, 23 (3.09%) patients were declared treatment failures, 7 (0.94%) patients were lost to follow-up, and 45 (6.05%) patients died during treatment.^{3,5} In lymph node TB, out of a total of 270 cases, 57 (21%) cases needed extension of the duration of treatment. In pleural TB, out of a total of 236 cases, 13 (5.5%) cases needed extension of the duration of treatment. CNS, bone and joint, and abdominal TB patients were most efficiently cured without the need for extension of the duration of treatment.¹ Out of a total of 45 patients who died, most were from pleural TB, 21 (46.67%), and CNS TB, 12 (26.67%). Mortality was most commonly seen in older age-group patients than in younger age-groups.⁵ Out of the total treatment failure cases, most were from lymph node TB (Table 1).

The above Table 1 shows there is a high incidence of EPTB cases in the age-groups 15–28 years (34%) and 29–42 years (26%), affecting the younger age-groups, which are the productive population of the country, showing the burden of EPTB.

The above pie chart shows the most commonly affected site in EPTB is the lymph node, followed by the pleura (Fig. 1). These two sites comprise >68% of all EPTB cases.

Table 1: Age- and sex-wise distributions of EPTB cases

Age-group (years)	Male	Female	Total (%)
1–14	43 (5.7%)	34 (4.3%)	77 (10%)
15–28	145 (20%)	104 (14%)	249 (34%)
29–42	116 (16%)	76 (10%)	192 (26%)
43–56	90 (12%)	37 (5%)	127 (17%)
57–70	43 (6%)	24 (3%)	67 (9%)
71–84	23 (2.2%)	8 (1.1%)	31 (3.3%)
>85	1 (0.7%)	0	1 (0.7%)
	461 (62.6%)	283 (37.4%)	744 (100%)

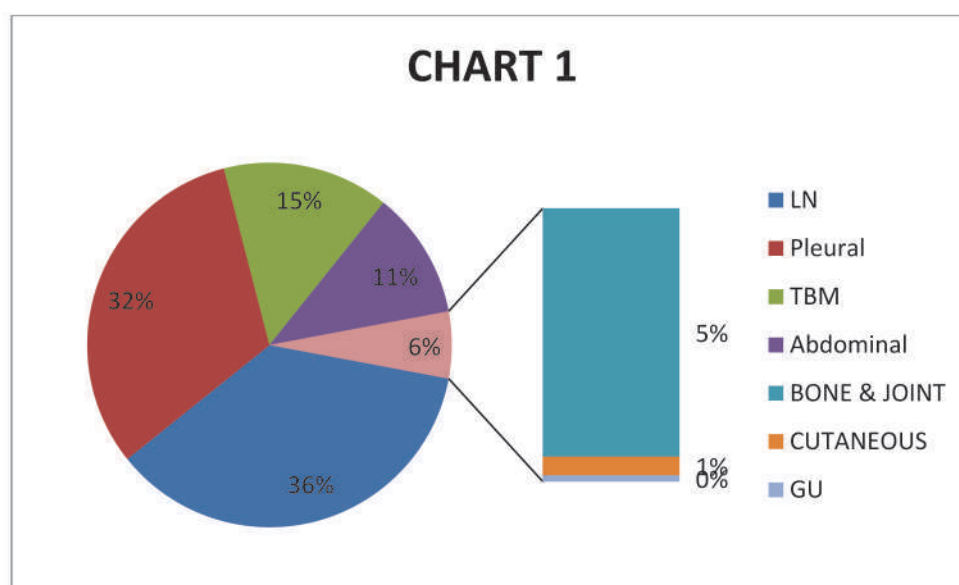


Fig. 1: EPTB site-wise distribution. The pie chart shows that the most common affected site in EPTB is the lymph node, followed by the pleura. These two sites comprise >68% of all EPTB cases

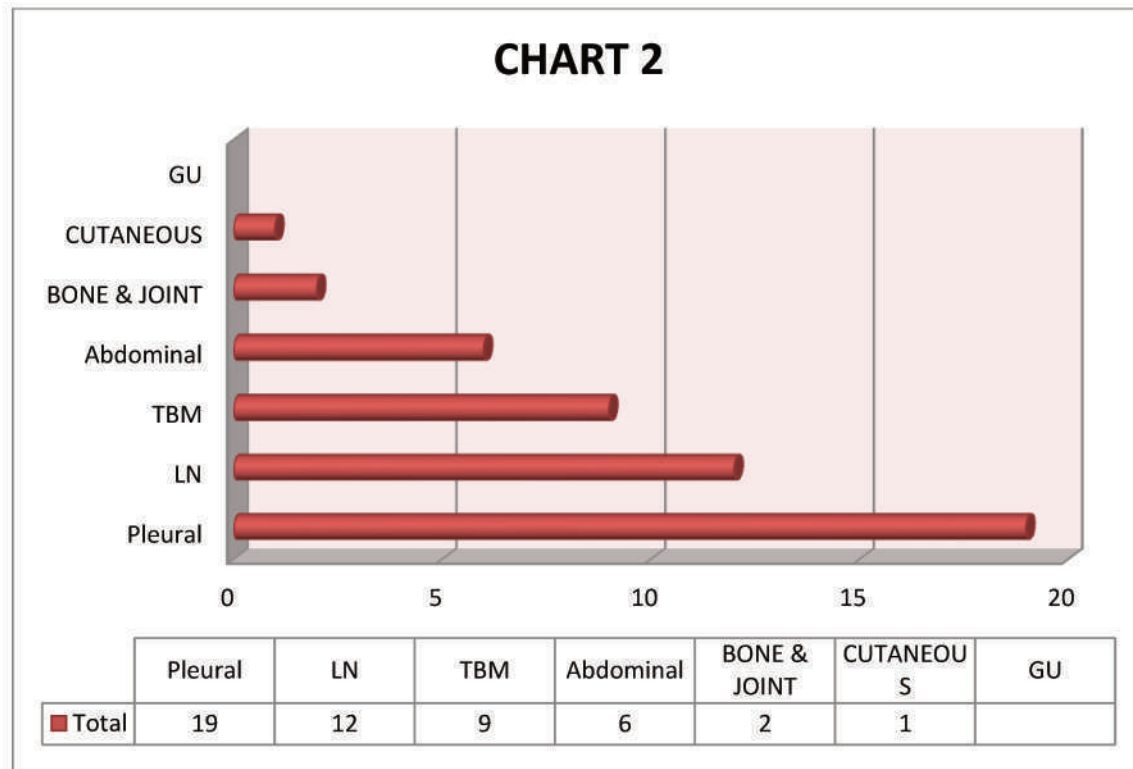


Fig. 2: EPTB site distribution in HIV-reactive patients. The bar graph shows that pleural TB was the most common site seen in the HIV-reactive population in our study

Table 2: Treatment outcome of EPTB cases

Outcome	Total
Cured	669 (89.91%)
Treatment failure	23 (3.09%)
Lost to follow-up	7 (0.94%)
Died	45 (6.05%)

The above bar graph shows that, in the HIV-reactive population, pleural TB was the most common site seen in our study (Fig. 2).

The above Table 2 shows the cure rate in our study is 89.91%, which is higher than in some other studies done in India and is almost at the target of the WHO End TB Strategy of >90% cure rate (Table 3).

DISCUSSION

The study was conducted to know the demographic and treatment outcomes of various EPTB patients in this study.

Firstly, out of a total of 744 EPTB cases, male patients (461, 61.96%) contributed more than female patients (283, 38.04%) overall. The majority of cases (740, 99.46%) were drug-sensitive TB and received a drug-sensitive TB treatment regimen (IP phase-4FDC, CP phase-3FDC), and 4 cases were drug-resistant EPTB cases for which a standard drug-resistant TB regimen was started. The majority of cases (441, 59.28%) belonged to the age-group of 15–42 years, who are young and working individuals, highlighting the socioeconomic burden of EPTB. Similar reports of a higher incidence of EPTB in younger individuals are reported by other studies as well.^{4,6,7} The number of cases in the pediatric age-group (<14 years) registered for treatment was 77 (10.35%) in this study. In

this study, the overall incidence of EPTB site-wise was lymph node (36.7%), pleural (29.84%), CNS (14.78%), abdominal (11.28%), bone and joint (5.37%), cutaneous (0.40%), and genitourinary (0.13%). Similar reports of a higher incidence of lymph node and pleural TB are reported by other studies as well.^{3,8–10} In the HIV-reactive population, the most common site in our study was lymph node, followed by pleural TB (Tables 4 to 6).

Secondly, lymph node and pleural TB were the common EPTB cases in the age-group of 15–42 years. Lymph node TB cases occurred more commonly in the younger age-group below 42 years than in older age-groups, with slight male predominance. However, pleural TB was the most common type of presentation in the age-groups of 43–70 years as well as >70 years, with pleural TB more common in male than female cases in all age-groups. Similar reports of a higher incidence of lymph node and pleural TB in younger age-groups are reported by other studies as well.^{4,8–11} This raises the possibility that the probability of reactivation in the pleura may be higher as age increases. Lymph node tuberculosis was the commonest type of EPTB, accounting for 53.25% of total cases in the age-group of 0–14 years.¹² A total of 48 cases were HIV-reactive, 6 had diabetes, and 1 patient had both HIV and diabetes (Table 7).

Thirdly, in lymph node TB, out of a total of 270 cases, 57 (21%) cases needed extension of the duration of treatment. In pleural TB, out of a total of 236 cases, 13 (5.5%) cases needed extension of the duration of treatment. CNS, bone and joint, and abdominal TB patients were most efficiently cured without the need for extension of the duration of treatment. The recommended duration of treatment for drug-sensitive lymph node, pleural, abdominal, pericardial, urogenital, cutaneous, and ENT TB is 6 months. For CNS TB, it is 9 months, and for bone, joint, and spinal TB, it is 12 months, with extension of duration done on a case-to-case basis.¹ Out of a

Table 3: Definitions for treatment outcome for EPTB cases

Outcome	Definition
Treatment completed	A TB patient who completed treatment without evidence of failure but with no record to show that sputum smear or culture results in the last month of treatment and on at least one previous occasion were negative, either because tests were not done or because results are unavailable
Treatment failure	Patients who were initially diagnosed as EPTB (with or without bacteriological confirmation), and those started on treatment based on clinical and radiological findings, who have not shown clinical improvement or became smear (or culture) positive or their condition deteriorated during the course of treatment. This definition excludes those patients who are diagnosed with RR-TB or MDR-TB during treatment
Died	A TB patient who dies for any reason before starting or during the course of treatment
Loss to follow-up	A TB patient who did not start treatment or whose treatment was interrupted for 2 consecutive months or more
Not evaluated	A TB patient for whom no treatment outcome is assigned. This includes cases "transferred out" to another treatment unit as well as cases for whom the treatment outcome is unknown to the reporting unit
Favorable treatment outcome	Patients categorized as treatment completed

Adapted from: Definitions and Reporting Framework for Tuberculosis—2013 Revision, World Health Organization.

Table 4: Age-wise EPTB distributions comparison

Arora and Gupta, 2006 (n = 2,849) ⁶		Prakasha et al. (n = 528) ⁴		Present study (n = 744)		Khan et al. (n = 1,222) ⁸	
Age-group	No.	Age-group	No.	Age-group	No.	Age-group	No.
≤14	611 (21%)	0–14	46 (8.71%)	1–14	77 (10%)	≤15	55 (4.5%)
15–24	1,074 (38%)	15–44	269 (50.95%)	15–28	249 (34%)	16–25	177 (14.5%)
25–34	725 (25%)	45–64	162 (30.68%)	29–42	192 (26%)	26–35	296 (24.2%)
35–44	274 (10%)	≥65	51 (9.66%)	43–56	127 (17%)	36–45	224 (18.3%)
45–54	92 (3%)			57–70	67 (9%)	46–55	233 (19.1%)
55–64	45 (2%)			71–84	31 (3.3%)	56–65	170 (13.9%)
≥65	28 (1%)			≥85	1 (0.7%)	≥65	67 (5.5%)

Table 5: Sex-wise EPTB distributions comparison

	Arora and Gupta, 2006 (n = 2,849) ⁶	Prakasha et al. (n = 528) ⁴	Present study (n = 744)	Khan et al. (n = 1,222) ⁸
Sex				
Male	1,225 (43%)	272 (51.52%)	461 (62%)	778 (63.7%)
Female	1,624 (57%)	256 (48.48%)	283 (38%)	444 (36.3%)

Table 6: EPTB site-wise comparison

	Arora and Gupta, 2006 (n = 2,849) ⁶	Prakasha et al. (n = 528) ⁴	Present study (n = 744)	Khan et al. (n = 1,222) ⁸
Site				
Lymph node	1,530 (53.7%)	131 (24.81%)	270 (36%)	324 (26.5%)
Pleural	817 (28.7%)	148 (28.03%)	236 (32%)	227 (18.6%)
CNS	29 (1%)	66 (12.5%)	110 (15%)	122 (9.98%)
Abdominal	192 (6.7%)	51 (9.66%)	84 (11%)	105 (8.59%)
Bone/joints/spinal	201 (7%)	65 (12.31%)	40 (5%)	209 (17.1%)
Cutaneous	5 (0.2%)	9 (1.7%)	3 (0.87%)	–
Genito-urinary	36 (1.3%)	23 (4.36%)	1 (0.13%)	–
Other	39 (1.4%)	35 (6.63%)	–	235 (19.23%)*

*Include EPTB other than mention in study

total of 49 HIV-reactive patients, 42 were cured, 6 died, and 1 was assigned a lost-to-follow-up outcome.

Fourthly, in this study, out of a total of 744 EPTB cases, 669 (89.91%) patients were declared cured, 23 (3.09%) patients were declared treatment failures, 7 (0.94%) patients were lost to follow-up, and 45 (6.05%) patients died during treatment. As compared with other studies done in India, our study showed a

higher treatment success rate, a lower treatment defaulter rate, and a higher death rate.⁵ Out of a total of 45 patients who died, most were from pleural TB, 21 (46.67%), and CNS TB, 12 (26.67%), which is reversed compared to other studies.⁵ Mortality was most commonly seen in older age-group patients than in younger age-groups. Out of the total treatment failure cases, most were from lymph node TB.⁵ Out of a total of 49 HIV-reactive patients, 42 were cured, 6 died,

Table 7: HIV-reactive EPTB site comparison

	<i>Wang et al. (n = 201)¹⁸</i>	<i>Alemu et al. (n = 72)</i>	<i>Present study (n = 49)</i>
EPTB site			
Lymph node	64 (32%)	40 (56%)	12 (24%)
Pleural	22 (11%)	11 (15%)	19 (39%)
CNS	87 (43%)	2 (3%)	9 (18%)
Abdominal	16 (8%)	5 (7%)	6 (12%)
Others	12 (6%)	14 (19%)	3 (7%)

Table 8: EPTB treatment outcome comparison

	<i>Khan et al. (n = 1,222)⁸</i>	<i>Atif et al. (n = 651)¹⁷</i>	<i>Present study (n = 744)</i>
Treatment outcome			
Cured	826 (67.59%)	463 (71.1%)	669 (89.91%)
Treatment failure		2 (0.3%)	23 (3.09%)
Lost to follow-up		165 (25.4%)	7 (0.94%)
Died		10 (1.5%)	45 (6.05%)
Not evaluated		11 (1.7%)	–
Other*	396 (32.41%)		

*Outcome other than successful include (treatment failure, lost to follow-up, died, not evaluated)

and 1 was assigned a lost-to-follow-up outcome. Out of the total outcome-available EPTB cases, 14 (4.1%) cases had recurrence of pulmonary TB. Out of the total outcome-available cases, 39 (5.82%) cases had a history of recurrence of EPTB (Table 8).¹³

CONCLUSION

In our study, lymph node TB (36%) was most common, followed by pleural (32%) and CNS TB (12%), which is in line with other studies done in India.^{3,5} The treatment success rate in our study was 89.91%, which is almost at the target of >90% treatment success rate of the WHO End TB Strategy 2035.^{14,15}

The burden of EPTB is greater among the productive age-group. The difference in the occurrence of various types of EPTB cases in different age-groups and sexes, without a declining trend, highlights the importance of strengthening the services for this vulnerable group. Higher reporting of EPTB cases in tertiary centers necessitates the need for ongoing medical education on a larger scale and well-defined program-specific protocols for the diagnosis and treatment of EPTB cases.^{16–18}

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Assessing Preoperative Pulmonary Function: Comparing Spirometry, Six-minute Walk Test, Peak Expiratory Flow Rate, and Breath-hold Test in Surgical Patients

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ABSTRACT

Background: Preoperative pulmonary function assessment is essential for predicting postoperative complications, especially in patients with respiratory conditions. While spirometry is the standard, simpler alternatives such as the 6-minute walk test (6MWT), peak expiratory flow rate (PEFR), and breath-hold test (BHT) may offer practical options in resource-limited settings.

Aims and objectives: This study aims to evaluate the correlation between spirometry and simpler tests (6MWT, PEFR, and BHT) to determine their utility as predictive tools for surgical outcomes in resource-constrained environments.

Materials and methods: A prospective study was conducted on 100 surgical patients who underwent spirometry, 6MWT, PEFR, and BHT. Data were analyzed using Spearman's correlation and multivariate regression to assess associations between these tests and key spirometric measures, including forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1%), and FEV1/FVC ratio.

Results: PEFR showed moderate, significant correlations with FVC ($r = 0.320, p < 0.01$) and BHT ($r = 0.492, p < 0.01$). Multivariate regression indicated PEFR as a significant predictor of FEV1% (OR = 1.010, $p < 0.05$) and BHT for FVC. However, none of the simpler tests significantly predicted the FEV1/FVC ratio, limiting their ability to detect obstructive patterns.

Conclusion: PEFR and BHT demonstrate potential as preliminary assessment tools in preoperative settings where spirometry is unavailable. However, they cannot replace spirometry for a comprehensive evaluation of pulmonary function.

Keywords: Breath-hold test, Peak expiratory flow rate, Preoperative assessment, Pulmonary function, Six-minute walk test, Spirometry.

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INTRODUCTION

Preoperative assessments of patients undergoing surgery are a crucial step in predicting and preventing postoperative complications, particularly in those with underlying respiratory conditions. Pulmonary function tests (PFTs) such as spirometry have long been used to assess lung function and predict the risk of postoperative pulmonary complications (PPCs) in nonthoracic surgery.^{1,2} However, spirometry requires specialized equipment and trained personnel, making it less accessible in resource-limited settings. As a result, there is growing interest in simpler, more accessible tests that can provide valuable insights into a patient's respiratory status.

The six-minute walk test (6MWT) is commonly used to assess aerobic fitness, requiring minimal equipment. It measures cardiovascular, respiratory, and musculoskeletal responses to exertion.³ Previous studies show its prognostic value in respiratory and cardiac patients, and it is increasingly used for preoperative risk stratification.^{4,5} Patients walking less than 70% of their predicted distance have a higher risk of PPCs.^{6,7}

Peak expiratory flow rate (PEFR) is another simple test that measures the maximum flow rate achieved during a forceful exhalation. PEFR is easy to use, portable, and inexpensive, making it a practical tool for monitoring airway limitation, particularly in asthmatic patients.^{8,9} Regularly monitoring PEFR can be beneficial for adjusting treatment in patients with chronic respiratory conditions.^{10,11}

The breath-holding test (BHT) measures how long a patient can hold their breath, reflecting respiratory muscle strength and lung

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capacity. Poor BHT performance may indicate early COPD. This study explores the correlation between spirometry, 6MWT, PEFR, and BHT in surgical patients to assess these simpler tests' effectiveness in improving preoperative assessments and identifying high-risk patients.¹²

MATERIALS AND METHODS

Study Design

The study employed a simple random sampling technique to select participants who met the inclusion and exclusion criteria. A total of 100 patients scheduled for surgery were included in

the study, and the study was conducted in the Department of Respiratory Medicine at Saveetha Medical College and Hospital.

Inclusion Criteria

- Individuals over 18 preparing for surgery who require spirometry.
- Volunteers with normal spirometry results, aged over 18.

Exclusion Criteria

- Patients unwilling to participate.
- Patients with invalid spirometry tests per American Thoracic Society (ATS) standards.
- Patients with contraindications for spirometry, such as recent myocardial infarction or conditions causing suboptimal tests (e.g., chest, abdominal, or facial pain).

Data Collection

Patients visiting the respiratory medicine OPD underwent spirometry [forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1)], PEFR, 6MWT, and BHT. Spirometry and 6MWT followed ATS guidelines. PEFR was recorded from the best of three readings, and BHT was measured with three trials and a 5-minute interval.

Statistical Analysis

Data analysis was performed using SPSS 27. Spearman's correlation coefficients assessed relationships among spirometry, PEFR, 6MWT, and BHT. Multivariate logistic regression, adjusted for age, gender, BMI, smoking, and comorbidities, evaluated the predictive capacity of PEFR, 6MWT, and BHT for spirometric outcomes (FVC, FEV1%, FEV1/FVC ratio), with odds ratios and 95% confidence intervals calculated to identify significant predictors.

RESULTS

Anthropometric Characters

The study included 100 patients with an average age of 50.21 ± 14.48 years. There were slightly more males (55%) than females (45%). The mean height and weight were 157.9 ± 7.337 cm and 60.56 ± 14.92 kg, respectively, with an average BMI of 24.23 ± 5.738 , indicating variability within a generally normal BMI range.

Regarding comorbidities, 44% had no significant health issues, while 33% had systemic hypertension (SHTN) and 23% had type 2 diabetes mellitus (T2DM). Smoking was prevalent, with 67% reporting a history of smoking, while 37% consumed alcohol and 63% abstained. Clinically, 28% of patients experienced breathlessness, 22% had a cough with expectoration, and 50% suffered from shortness of breath (SOB). Despite these symptoms, only 14% required long-term oxygen therapy (LTOT), while 86%

did not. The Modified Medical Research Council (MMRC) dyspnea scale classified most patients as grade 2 (46%) or grade 3 (45%), with 9% in grade 4 (Table 1).

Correlation Analysis

Spearman's rho analysis revealed significant correlations among pulmonary function tests (PFTs), exercise capacity (6MWT), and respiratory endurance (BHT). PEFR was moderately correlated with FVC ($r = 0.320$, $p < 0.01$) and FEV1 ($r = 0.322$, $p < 0.01$), and strongly with BHT ($r = 0.492$, $p < 0.01$). FVC correlated strongly with FEV1 ($r = 0.943$, $p < 0.01$) and showed positive correlations with FEV1/FVC ($r = 0.278$, $p < 0.01$) and BHT ($r = 0.232$, $p < 0.05$). The 6MWT had weak, nonsignificant correlations with FVC ($r = -0.066$) and FEV1 ($r = -0.095$). The distance covered in 6MWT showed a weak but significant correlation with BHT ($r = 0.211$, $p < 0.05$) (Table 2).

Multivariate Regression Analysis

To address the potential influence of confounding factors on spirometric outcomes, a multivariate regression analysis was conducted, adjusting for age, gender, BMI, smoking history, and comorbidities (e.g., systemic hypertension, type 2 diabetes mellitus) as covariates. This analysis evaluated the predictive value of simplified pulmonary tests—specifically, PEFR, 6MWT distance, and BHT—on key spirometric measures: FVC, FEV1%, and FEV1/FVC ratio.

Forced Vital Capacity (Normal vs Low)

In the adjusted model, breath hold was found to be a significant predictor of FVC in model A (OR = 1.123, 95% CI: 1.025–1.230, $p < 0.05$), even after adjusting for age, gender, BMI, smoking history, and comorbidities. This suggests that a

Table 1: Anthropometric characteristics

Parameters	No. of patients (n = 100)
Age	50.99 $\pm$ 18.89
Gender (male/female)	44/56
Height (cm)	158.4 $\pm$ 6.641
Weight (kg)	60.62 $\pm$ 15.21
BMI	24.20 $\pm$ 5.811
Comorbidity (Nil/SHTN/T2DM)	45/34/21
Smoking status (Yes/No)	61/39
Alcohol consumption status (Yes/No)	31/69
Complaints (breathlessness/cough with expectoration/SOB)	26/23/51
LTOT (Yes/No)	12/88
MMRC Grade (2/3/4)	45/45/10

Table 2: Correlation of pulmonary function test and PEFR, 6MWT, BHT

Variable	FVC	FEV1	FEV1/FVC	Distance Covered (Meter)	BHT (Seconds)
PEFR	0.198*	0.192	0.063	0.358**	0.383**
FVC		0.832**	0.297**	0.051	0.256*
FEV1			0.642**	0.048	0.275**
FEV1/FVC				-0.082	0.053
Distance covered (meter)					0.499**

higher breath-holding capacity may independently contribute to a higher likelihood of normal FVC. In contrast, neither PEFR nor 6MWT-distance covered was found to have statistically significant associations with FVC in the adjusted models (models A and B), with ORs close to 1 and confidence intervals overlapping 1.

FEV1% (Normal vs Low)

The multivariate analysis indicated that PEFR remained a significant predictor of FEV1% across both model A and model B, with an OR of 1.010 (95% CI: 1.002–1.018, $p < 0.05$), even after adjustments for potential confounders. This finding supports the use of PEFR as an independent predictor of normal FEV1%, highlighting its potential utility as a preliminary assessment tool. Neither 6MWT-distance covered nor breath-hold reached statistical significance for predicting FEV1% when controlling for other variables.

FEV1/FVC Ratio (Obstructive vs Nonobstructive)

No significant associations were found between the simplified tests and the FEV1/FVC ratio in either model. Both PEFR and breath hold showed ORs close to 1, and their confidence intervals included 1, suggesting limited predictive value for the FEV1/FVC ratio. These results indicate that the simplified tests may not reliably predict obstruction patterns in the absence of spirometric data (Table 3).

Table 3: Predictive value of simplified pulmonary assessments on spirometric outcomes: multivariate regression result

Respiratory parameters	Model	OR	95% CI	
			Lower	Upper
FVC (normal vs low)				
PEFR	A	1.001	0.995	1.006
	B	0.998	0.991	1.004
6MWT-distance covered	A	1.001	0.997	1.004
	B	0.999	0.995	1.003
Breath hold	A	1.123*	1.025	1.23
	B	1.095	0.974	1.23
FEV1% (normal vs low)				
PEFR	A	1	0.995	1.006
	B	0.999	0.992	1.006
6MWT-distance covered	A	1.001	0.998	1.005
	B	1.002	0.997	1.006
Breath hold	A	1.09	0.993	1.197
	B	1.118	0.983	1.272
FEV1% (normal vs low)				
PEFR	A	1.010*	1.002	1.018
	B	1.010*	1.001	1.018
6MWT-distance covered	A	1.001	0.997	1.005
	B	0.997	0.992	1.002
Breath hold	A	1.092	0.968	1.232
	B	1.007	0.857	1.184

Models: A, unadjusted, B, adjusted for age, gender, BMI, smoking history, and comorbidities (e.g., systemic hypertension, type 2 diabetes mellitus); OR, odds ratio; CI, confidence interval; * $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$, showed a significant difference.

DISCUSSION

This study evaluated the predictive utility of simplified pulmonary function tests—specifically the 6MWT, PEFR, and BHT—for key spirometric outcomes (FVC, FEV1%, and FEV1/FVC ratio) in a preoperative assessment context.

The correlation analysis revealed moderate, significant associations between PEFR and FVC ($r = 0.320$, $p < 0.01$) and between PEFR and BHT ($r = 0.492$, $p < 0.01$). These findings are consistent with prior studies that support PEFR as a practical, accessible indicator of lung function. For example, Hajare et al. demonstrated significant correlations between PEFR and FEV1% in patients with obstructive lung conditions, suggesting that PEFR could serve as a surrogate measure for respiratory function when spirometry is unavailable.¹³ Similarly, our finding aligns with research by Kundu et al., who reported that PEFR effectively reflects airflow and lung function, particularly in chronic respiratory disease populations.¹⁴

Conversely, the correlation between 6MWT and spirometric measures such as FVC ($r = -0.066$) and FEV1 ($r = -0.095$) was weak and statistically nonsignificant, a finding that diverges from studies like those by Krishna et al. and Hajare et al., which reported stronger correlations between 6-minute walk distance and FEV1 in COPD patients.^{13,15} This discrepancy may be due to variations in patient populations or the effects of underlying comorbidities, which were adjusted for in our regression models but may not have been fully controlled in prior studies.

The regression analysis further underscored the role of PEFR as a predictor of FEV1%. In both unadjusted and adjusted models, PEFR was significantly associated with normal FEV1% (OR = 1.010, 95% CI: 1.002–1.018, $p < 0.05$), supporting its independent predictive value. Our findings are consistent with those by Dinakar et al. and Chang et al., who demonstrated the utility of PEFR in predicting postoperative respiratory function and underscored its relevance as a cost-effective assessment tool in resource-constrained settings.^{16,17}

Breath-hold test (BHT) showed a significant association with FVC in the unadjusted regression model (OR = 1.123, 95% CI: 1.025–1.230, $p < 0.05$). This aligns with studies by Sameed et al., who identified breath-holding capacity as a marker of respiratory muscle strength and endurance in respiratory assessments.⁵ However, our adjusted model did not retain this association, suggesting that BHT may be sensitive to demographic and clinical variables such as anxiety and technique. This finding echoes the work of Santos et al., who reported that BHT is influenced by factors outside of pulmonary function, potentially limiting its reliability as a standalone predictor.⁶ These findings suggest that while PEFR and breath hold may serve as useful screening tools in resource-limited settings, they cannot substitute for spirometry's comprehensive assessment, particularly in complex respiratory conditions. The necessity of controlling for confounding factors was underscored by this analysis, strengthening the reliability of these associations.

Finally, the FEV1/FVC ratio showed no significant associations with any simplified tests, consistent with studies indicating that simpler tests do not capture obstructive impairments effectively. Previous work by Holland et al. and Santos et al. has similarly noted that simplified assessments such as PEFR and 6MWT may lack the sensitivity needed to evaluate the nuances of obstructive disease patterns.^{3,6} This reinforces the essential role of spirometry for diagnosing and characterizing obstructive conditions, such as COPD, especially where precise assessment of FEV1/FVC is necessary.

The results suggest that while PEFR and, to a lesser extent, BHT may serve as preliminary tools for assessing FEV1% and FVC, they

do not provide a comprehensive evaluation of pulmonary function. The robust association of PEFR with FEV1% across both unadjusted and adjusted models supports its application as a screening tool in resource-limited settings, where full spirometry may be unavailable. In contrast, the limited predictive value of 6MWT and BHT across spirometric measures suggests that these tests may not be reliable substitutes for spirometry, although they may offer supplementary insights in specific cases.

This study's single-institution sample may limit the generalizability of findings, and the sample size ($n = 100$) restricts statistical power. External factors such as patient motivation and comorbidities could have influenced 6MWT and BHT outcomes, a limitation also noted in previous studies. Future research with larger, multicenter populations and standardized testing conditions would enhance the robustness of these findings. Moreover, examining postoperative outcomes related to simplified test performance could provide valuable evidence on their predictive utility in surgical contexts.

CONCLUSION

In conclusion, while PEFR and BHT show potential for preliminary assessment in preoperative settings, they cannot fully replace spirometry's comprehensive evaluation, particularly for identifying obstructive patterns. These results align with prior research supporting the cautious use of simplified tests, particularly PEFR, in clinical settings where spirometry access is limited.

DECLARATION

Ethical Approval

Ethical clearance was obtained from the Institutional Ethics Committee of Saveetha Medical College. All patients provided written informed consent in both English and Tamil, understanding the study's procedures before participating.

AI AND AI-ASSISTED TECHNOLOGIES USAGE

Generative AI and AI-assisted tools were used in preparing this manuscript. ChatGPT 4.0 helped construct the manuscript's backbone, Grammarly checked spelling and grammar, and QuillBot was used for paraphrasing and proofreading. The authors are fully responsible for the final content.

AUTHOR'S CONTRIBUTION

Swetha Sasikumar and Prasanth Gururaj collected and interpreted the data. Swetha Sasikumar, Sakthi Bhalan Pandiarajan, and Anbumaran Parivakkam Mani drafted the manuscript. Gangadharan Vadivelu reviewed and revised the manuscript. All authors contributed equally and agreed to be accountable for all aspects of the work.

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Awareness and Practice of Oral Hygiene among Adolescents Residing in the Rural Field Practice Area of a Medical College, West Bengal, India: A Cross-sectional Study

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ABSTRACT

Introduction: Adolescence is a period of increased risk of oral diseases—periodontal infections and dental caries. Awareness and practice of oral hygiene are fundamentally important for maintaining good oral health. The present study was conducted among adolescents residing in a rural area to estimate the proportion of awareness on oral hygiene, to assess their practice, and to identify the factors associated (if any) with awareness and practice.

Materials and methods: An observational study, cross-sectional in design, was conducted among 250 adolescents residing in the rural field practice area of a medical college in West Bengal from June to August 2022 using a predesigned, pretested, structured schedule by face-to-face interview. Data were analyzed using SPSS v25.0 by suitable descriptive and inferential statistics. Multivariable binary logistic regression was performed to find out the association.

Results: Out of 250 adolescents, about 53.6% of the study population had adequate awareness of oral hygiene. However, 55.2% had unsatisfactory practice. The education of the mother [AOR 3.94 (1.53–10.11)] and occupation of father [AOR 2.10 (1.01–4.39)] had statistically significantly higher odds of inadequate awareness on oral hygiene. Female gender [AOR 1.98 (1.11–3.56)], education of father: primary [AOR 8.77 (2.19–35.13)], middle school [AOR 5.35 (1.48–19.32)], secondary [AOR 3.26 (1.17–9.11)] and nuclear family [AOR 2.47 (1.37–4.46)] had statistically significantly higher odds of unsatisfactory practice in the multivariable model.

Conclusion: Adolescents had adequate awareness of oral hygiene, but their practice was very unsatisfactory. Information, education, and communication (IEC) programs should be carried out to increase awareness and improve practice on oral hygiene among adolescents, especially in rural areas.

Keywords: Adolescent, Awareness, Oral hygiene, Rural.

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INTRODUCTION

Oral health not only refers to healthy teeth but also the health of the gums, oral soft tissues, chewing muscles, the palate, tongue, lips, and salivary glands.¹ Oral diseases such as caries of the teeth, gingivitis, and pyorrhea are regarded as having a huge burden of dental health problems, particularly in developing countries.² More than three-fourths of the world's population have encountered oral caries or bad breath at least once in their lifetime.³

According to The Global Burden of Disease 2019, oral diseases affect nearly 3.5 billion people, with caries of permanent teeth, mostly in children.¹ Irrespective of age group and sex, oral disorders are 0.91% (0.56–1.41%) of total DALYs (disability-adjusted life years) as per the 2019 report.³ In low- and middle-income countries, including India, the prevalence of oral diseases increases with growing urbanization and poor socioeconomic conditions, but the situation is not so much explored in rural areas.⁴ Moreover, oral health is often neglected by the majority of population in such countries.⁵

Adolescence is a period of increased risk for oral diseases such as periodontal infections and dental caries. Poor dental hygiene has several other consequences in them such as physical pain that leads to sleep disorders, eating problems, and behavioral problems.^{6,7} Most oral health conditions are largely preventable and can be treated in their early stages. Nearly 70% of the Indian

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population resides in rural areas and seeks health care from primary health centers. Treatment for oral health conditions is at times expensive and usually not part of universal health coverage.¹

Oral disease is included in neglected tropical diseases, and the risk factors common to noncommunicable diseases, such as high



sugar intake, all forms of tobacco use, and harmful use of alcohol has a contribution to the global oral health crisis.²

People of the world, as well as India has forgotten that maintenance of oral hygiene helps to keep health lifestyle. Awareness of oral health is fundamentally important for maintaining good oral health, and proper oral hygiene is considered a lifetime practice. There is a dearth of studies on awareness and practice of oral hygiene among adolescents residing in rural areas of West Bengal. Most studies that have been conducted in similar settings are school-based. Only a few studies are based on household surveys.

With this background and rationale, this study was conducted among adolescents residing in the rural field practice area of a Medical College in West Bengal with the objectives to estimate the proportion of awareness on oral hygiene, to assess their practice and to identify the factors associated (if any) with awareness and practice.

MATERIALS AND METHODS

Study Type and Design

The study was a descriptive type of observational study and cross-sectional design.

Study Settings and Study Period

This study was conducted in the villages Muchisa and Chakdaulat of Budge-Budge II block, West Bengal, for a period of 12 weeks (June 2022–August 2022).

Study Population and Selection Criteria

The study population was adolescents residing in the villages. Inclusion criteria were the age group of 10–19 years and those who were permanent residents of the place (≥ 10 years with their family). Those who were seriously ill and did not give informed written consent or assent (as applicable) were excluded from the study.

Sample Size

A proportion of awareness on oral hygiene was taken from a study conducted by Madhumitha et al.⁸ among the adolescent population in Arni, Tamil Nadu, as 82%, confidence interval (CI) = 95%; standard normal deviate ($Z_{\alpha/2}$) at 95% CI = 1.96, absolute error (d) = 5%, sample size was calculated using Cochran's formula:

$$n = [Z_{1-\alpha/2}^2 \times p(1-p)]/d^2 = 227$$

The final sample size was rounded off to 250 after adding 10% nonresponse rate.

Sampling Technique

The sampling technique was simple random sampling. Villages Muchisa and Chakdaulat come under a single subcenter, Muchisa. A list maintained by an auxiliary nurse midwife (ANM) for different adolescent programs at the subcenter was obtained, and a sampling frame was prepared. The required sample was selected by simple random sampling using the random number table method.

Study Tool

The study tool was a predesigned, pretested, structured schedule that was designed by a team of three experts, including one professor of community medicine, a dental expert, and a

pediatrician. It was prepared in English and later translated into Bengali. The schedule was then pretested among 20 randomly selected adolescents in the same area for its validity and reliability. Those selected for pretesting were not included in the final study population.

Study Variables

Dependent Variable

- Awareness of oral hygiene.
- Practice regarding oral hygiene.

Independent Variables

Sociodemographic characteristics: Age, gender, religion, caste, education of respondent, type of family, education and occupation of father, education and occupation of mother, and addiction history.

Study technique and data collection: For data collection, the households of the selected adolescents were visited. An outline of the study was narrated to them, including the nature and purpose of the study. Then, data were collected by the face-to-face interview method after taking informed written consent and assent as required, and informing them about their anonymity and confidentiality. All the responses were recorded in the schedule.

Study Procedure

The topic was selected, and objectives were formulated. Ethical approval was taken from the Institutional Ethics Committee, following which a schedule was designed and pretested among 20 participants from the selected subcenter and excluded from the study. Study populations were selected by simple random sampling after applying inclusion and exclusion criteria. Data were collected by face-to-face interviews, visiting house to house of the rural area, maintaining anonymity and confidentiality. The data were extracted and compiled accordingly.

Data Analysis

All 250 responses were included in analysis. Data were tabulated in Microsoft Excel 2019 (Microsoft Corp, Redmond, WA, USA) and then imported to Statistical Package for the Social Sciences (SPSS for Windows, version 25.0, SPSS Inc., Chicago, USA) for interpretation and analysis. Awareness was assessed on 10 questions. All the responses were scored. The maximum attainable score for awareness was 3. Participants who scored 15 or more were categorized to have adequate awareness, score of < 15 had inadequate awareness. There were six questions on practice on oral hygiene, where the maximum attainable score was 14. Those who scored ≥ 7 were considered to have satisfactory practice, and those who scored < 7 were considered to have unsatisfactory practice. Descriptive statistics were used to summarize the data. Multivariable binary logistic regression was performed to ascertain the relationship between the dependent and the independent variables. All independent variables having a p -value < 0.20 were considered biologically plausible to be included in the multivariable model. Data were checked for multicollinearity (VIF < 10), and variables with p -value < 0.05 were considered statistically significant in the final model.

Operational Definitions

- Adolescent: An individual who is aged between 10 and 19 years.⁹
- Ethical considerations: Institutional Ethics Committee permission was obtained prior to the start of the study (Institute Name/

IEC/2022/458 dated October 18, 2022). Informed written consent/assent was obtained before each interview (as applicable), and all ethical principles were strictly adhered to throughout the course of the study.

RESULTS

About 54% belonged to the age group 13–16 years, 54.5% were females, 81.9% belonged to the Hindu community, and about 59.6% were of the general caste. Concerning the education of parents, a little more than one-fourth (25.6% mothers and 25.2% fathers, respectively) had completed primary school. Around 86% of mothers of the study subjects were homemakers, while 34.4% of their fathers were unskilled workers. Nearly 52% of adolescents belonged to nuclear families, and 98.4% were unmarried. About 45.6% of study subjects belonged to the lower middle class (IV) as per the modified BG Prasad Scale 2021.¹⁰ About 2.4% of them were addicted to smokeless tobacco (Table 1).

The present study revealed that 53.6% of the study population had adequate awareness of oral hygiene. However, 55.2% of them had unsatisfactory practice (Fig. 1).

Out of 250 study participants 38.8% changed toothbrushes till bristle gets frayed, 30% were aware about roll brushing technique was good, around 33% felt injury to gums was the most common cause of bleeding gums, 43.2% knew that dental caries was a disease, according to 32% of them poor oral hygiene was the most common cause of bad breath, 54% were unaware of that coffee or tea can stain their teeth, only 33% were aware of that sensitivity to hot or cold food can be treated. When asking about the most common cause for loose teeth, 40% and 39% were conscious that old age and poor oral hygiene were the causes, and 43% of them had knowledge that bad oral hygiene affects general health, 47.2% were aware that improper brushing was the most common cause of receding gum (Table 2).

About 96% of them brushed their teeth daily, only 27.2% practiced it twice daily, 23.2% never used dental floss, 62.8% never used mouthwash, 56% of them never visited a dentist, and only 35% used roll type of brushing technique. 21% got no training regarding brushing technique, and 66% had an attitude to learn more about brushing technique (Table 3).

Multivariable binary logistic regression was performed to find factors associated with inadequate awareness. Education of mother-illiterate [AOR 3.94 (1.53–10.11)] and occupation of father-semiskilled [AOR 2.10 (1.01–4.39)] had statistically significantly higher odds of inadequate awareness on oral hygiene (Table 4).

Female gender [AOR 1.98 (1.11–3.56)], education of father-primary [AOR 8.77 (2.19–35.13)], middle school [AOR 5.35 (1.48–19.32)], Secondary [AOR 3.26 (1.17–9.11)] and belonging to nuclear family [AOR 2.47 (1.37–4.46)] were found to have statistically significant higher odds of unsatisfactory practice in the multivariable model (Table 5).

DISCUSSION

Oral diseases, which are mostly preventable, act as a major health burden for many developing countries and affect people throughout their lifetime.¹ In this study it was identified that, 54% belonged to age group 13–16 years, 54.5% were females, 25.6% mothers and 25.2% fathers of the participants had an educational level up to primary school, nearly 52% of adolescents belonged to nuclear families and 98.4% were unmarried, about 46% of study subjects belonged to lower middle class (IV) as per modified BG Prasad Scale 2021 and 2.4% of them were addicted to smokeless tobacco.¹⁰

Table 1: Distribution of the study subjects according to their sociodemographic characteristics (*n* = 250)

Sociodemographic variables		Number (%)
Age group	10–13 years	59 (23.6)
	13–16 years	135 (54.0)
	16–19 years	56 (22.4)
Gender	Male	114 (45.6)
	Female	136 (54.4)
Religion	Hinduism	203 (81.2)
	Islam	46 (18.4)
	Christianity	1 (0.4)
Caste	General	149 (59.6)
	Scheduled caste	57 (22.8)
	Scheduled tribe	2 (0.8)
	Other backward classes	41 (16.4)
	EWS	1 (0.4)
Education of respondent	Primary	34 (13.6)
	Middle school	133 (53.2)
	Secondary	55 (22.0)
	Higher secondary	28 (22.0)
Education of mother	Illiterate	36 (14.4)
	Primary	64 (25.6)
	Middle school	63 (25.2)
	Secondary	57 (22.8)
	Higher secondary	28 (11.2)
Education of father	Graduate	2 (0.8)
	Illiterate	41 (16.4)
	Primary	63 (25.2)
	Middle school	56 (22.4)
	Secondary	50 (20.0)
	Higher secondary	35 (14.0)
	Graduate	3 (1.2)
Occupation of mother	Postgraduate	2 (0.8)
	Homemaker	215 (86.0)
	Semiskilled	8 (3.2)
	Skilled	20 (8.0)
	Service	3 (1.2)
Occupation of father	Business	4 (1.6)
	Unskilled	86 (34.4)
	Semiskilled	54 (21.6)
	Skilled	78 (31.2)
	Service	27 (10.8)
Type of family	Business	4 (1.6)
	Nuclear	120 (48.0)
	Joint	130 (52.0)
Socioeconomic class (Modified BG Prasad scale 2021)	Upper (I)	8 (3.2)
	Upper middle (II)	20 (8.0)
	Middle (III)	51 (20.4)
	Lower middle (IV)	114 (45.6)
	Lower (V)	57 (22.8)
Marital status	Married	4 (1.6)
	Unmarried	246 (98.4)
Addiction	Nil	244 (97.6)
	Smokeless tobacco	6 (2.4)

Table 2: Distribution of the study subjects according to their awareness regarding oral hygiene (n = 250)

Information sought	Response	Number (%)
How frequently should brushes be changed	3 months	61 (24.4)
	6 months	26 (10.4)
	1 year	66 (26.4)
	Bristle gets frayed	97 (38.8)
Type of brushing technique is good for oral health	Horizontal	100 (40)
	Vertical	26 (10.4)
	Roll	75 (30)
	Not aware	49 (19.6)
The most common cause of bleeding gums	Vit C deficiency	37 (14.8)
	Poor oral hygiene	71 (28.4)
	Injury to the gums	81 (32.4)
	Not aware	61 (24.4)
Is dental caries a disease or not	Yes	108 (43.2)
	No	74 (29.6)
	Maybe	35 (14)
	Not aware	33 (13.2)
The most common cause of bad breath	Smoking	57 (22.8)
	Poor oral hygiene	79 (31.6)
	Lung disease	56 (22.4)
	Onion/garlic	58 (23.2)
Coffee or tea can stain teeth	Yes	69 (27.6)
	No	135 (54)
	Maybe	28 (11.2)
	Not aware	18 (7.2)
Sensitivity to hot or cold food can be treated or not	Yes	82 (32.8)
	No	67 (26.8)
	Maybe	38 (15.2)
	Not aware	63 (25.2)
The most common cause of a loose tooth	Old age	99 (39.6)
	Poor oral hygiene	97 (38.8)
	Accident	46 (18.4)
	Diabetes	8 (3.2)
Does bad oral hygiene affect general health or not	Yes	106 (42.4)
	No	84 (33.6)
	Maybe	38 (15.2)
	Not aware	22 (8.8)
The most common cause of receding gums	Improper brushing	118 (47.2)
	Nail biting	38 (15.2)
	Injury	85 (34)
	Diabetes	9 (3.6)

In this study, 30% were aware about roll brushing technique was good, around 33% felt injury to gums was the most common cause of bleeding gums, 43.2% knew that dental caries was a disease, 47.2% were aware that improper brushing was the most common cause of receding gum. When asking regarding brushing technique, about 96% of them brushed their teeth daily, only 27.2% practiced it twice daily, 23.2% never used dental floss, 62.8% never used mouthwash, 56% of them never visited a dentist, and only 35% used roll type of brushing technique.

In the Chennai study, it was observed that about 85.7% of respondents were aware of oral health, which was higher than

Table 3: Distribution of the study subjects according to their practice and attitude regarding oral hygiene (n = 250)

Information sought	Response	Number (%)
Brush your teeth daily	Yes	239 (95.6)
	No	11 (4.4)
Frequency of brushing per day	Once a day regularly	148 (59.2)
	Twice a day regularly	68 (27.2)
	Once daily irregularly	22 (8.8)
	Sometimes	12 (4.8)
Use of dental floss	Yes	58 (23.2)
	No	24 (9.6)
	Maybe	4 (1.6)
	Not aware	164 (65.6)
Frequency of mouthwash use	Never	157 (62.8)
	Once a week	26 (10.4)
	Once a day for 2 weeks	34 (13.6)
	Dentist	33 (13.2)
Frequency of visiting the dentist for teeth cleaning	Every 3 months	47 (18.8)
	Every 6 months	11 (4.4)
	Once a year	52 (20.8)
	Never	144 (56.0)
Type of brushing technique used	Horizontal	126 (49.2)
	Roll	88 (35.2)
	Vertical	39 (15.6)
Training on oral hygiene received from	Parents	155 (62.0)
	Dentist	27 (10.8)
	No one	54 (21.6)
	Internet	14 (5.6)
Wants to receive further information about oral health	Yes	165 (66.0)
	No	85 (34.0)

in this study (53.6%). About 55% of the study population were aware of bleeding gums, 21% of them used to use mouthwashes and 4% of the students opted for using dental floss. Comparing this information with the present study, it was seen that the majority of the respondents never used mouthwash (62.8%), and only 23.2% used dental floss.⁸ About 56% of the adolescents in the current study had never visited a dentist in their lives, which was 62.9% in the Hooghly study. A little more than half (52%) of school adolescents visited a dentist once a year as per Madhumitha et al.⁸

Mhaske et al. in Bhopal reported that 80% of public-school children cleaned their teeth using a toothbrush, whereas it was 95.6% in the present study.¹¹ A study in Hooghly, West Bengal, among school-going adolescents by Shree et al., reported that 57.7% of respondents brush their teeth twice or more than twice a day, which was greater than the present study (27.2%). Spandana et al., in a study of Rajamahendravaram, Andhra Pradesh, among school children, reported that around 96.4% practiced brushing their teeth only once a day and only 3.5% twice a day. As per Shireen et al., the majority of the Bengaluru high school girls brushed their teeth only once daily (74.4%).¹²⁻¹⁴

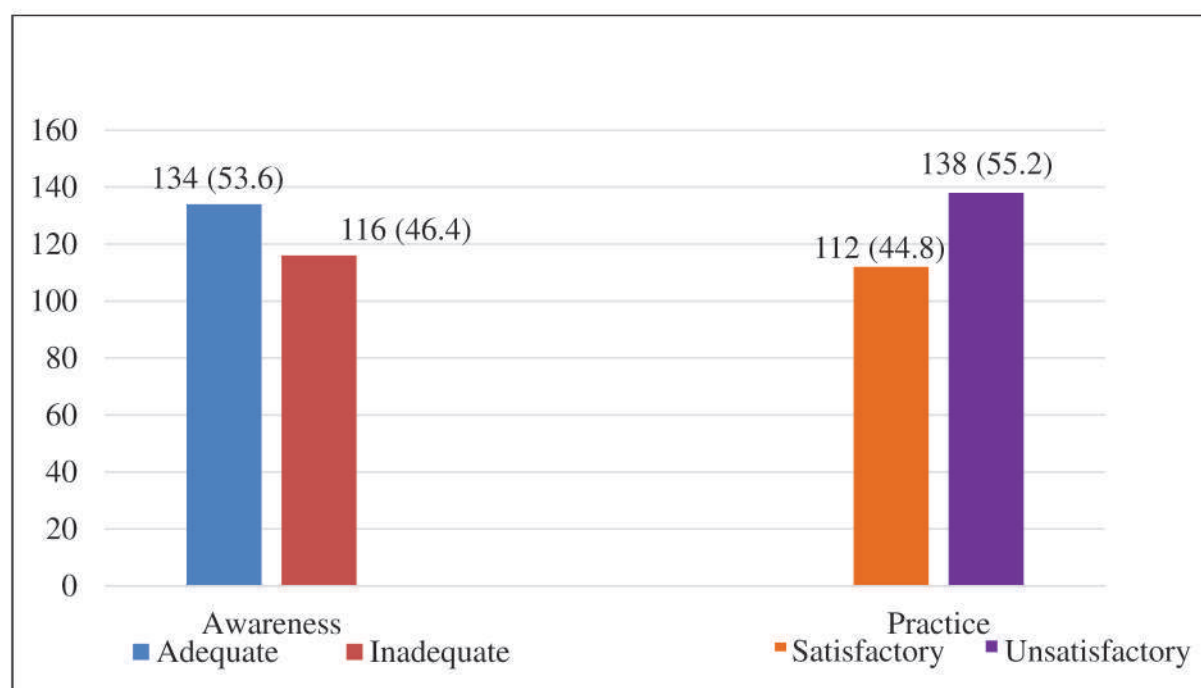


Fig. 1: Multiple bar diagram showing proportion of awareness and practice on oral hygiene (n = 250)

Table 4: Association between sociodemographic factors and inadequate awareness (n = 116)**

Sociodemographic variables		Inadequate awareness, n (%)	OR (95% CI)	AOR (95% CI)	p-value*
Education of mother	Illiterate	24 (66.7)	2.57 (1.14–5.81)	3.94 (1.53–10.11)	0.004
	Primary	27 (42.2)	0.94 (0.49–1.80)	1.09 (0.52–2.28)	0.804
	Middle school	27 (42.9)	0.96 (0.50–1.86)	1.11 (0.55–2.23)	0.787
	Secondary and above	38 (43.7)	Reference	Reference	—
Education of father	Higher secondary and above	20 (50.0)	1.15 (0.48–2.77)	2.32 (0.31–3.52)	0.761
	Secondary	24 (48.0)	1.11 (0.46–2.44)	2.92 (0.12–3.97)	0.527
	Middle school	24 (42.9)	0.86 (0.38–1.95)	1.07 (0.25–2.28)	0.725
	Primary	29 (46.0)	0.98 (0.44–2.17)	1.11 (0.37–2.39)	0.926
Occupation of mother	Illiterate	19 (46.3)	Reference	Reference	—
	Unskilled/homemaker	103 (47.9)	1.55 (0.74–3.24)	3.56 (0.61–4.45)	0.762
Occupation of father	Others	13 (37.1)	Reference	Reference	—
	Semi-skilled	29 (53.7)	1.56 (0.79–3.10)	2.10 (1.01–4.39)	0.040
	Skilled	33 (42.3)	0.99 (0.53–1.83)	1.33 (0.67–2.63)	0.411
	Service and business	17 (54.8)	1.64 (0.71–3.74)	2.31 (0.90–5.89)	0.080
Family type	Unskilled	37 (42.5)	Reference	Reference	—
	Nuclear	57 (47.5)	1.08 (0.66–1.79)	2.31 (0.76–3.12)	0.321
	Joint	59 (45.4)	Reference	Reference	—

*p-value < 0.05, considered as biologically plausible; **Binary logistic regression

About 44.8% of the study population had unsatisfactory practice on oral hygiene, whereas it was 50% in another Bengal study.¹² Around 72% of the study participants brushed their teeth in a horizontal direction, and 35.2% used the roll stroke method as pointed out by Spandana et al. in Rajamahendravaram, Andhra Pradesh.¹³

A study conducted in Bangladesh showed that 81% of the children used a toothbrush and toothpaste to clean their teeth, 15% used their finger or a neem stick, an abrasive such as toothpaste, charcoal, ash, or salt. Around 83% of them brushed

once daily, and only 17% brushed twice a day. Most children brushed in the morning, before or after their first meal, while only 8% brushed at night as well, before bedtime, 25% gargled and used mouthwash.¹⁵

A study conducted in Ranchi, Jharkhand, by Konwar et al. showed no significant association between sociodemographic characteristics and awareness of oral hygiene among middle school students. Similarly, in the Chennai study, no association was elicited with the sociodemographic profile. In the current study, the education of the mother and occupation of the father showed a statistically significant

Table 5: Association between sociodemographic factors and unsatisfactory practice (n = 138)**

Sociodemographic variables		Unsatisfactory practice, n (%)	OR (95% CI)	AOR (95% CI)	p-value
Gender	Female	88 (64.7)	2.34 (1.40–3.91)	1.98 (1.11–3.56)	0.022
	Male	50 (43.9)	Reference	Reference	—
Education of mother	Illiterate	27 (75.0)	3.69 (1.55–8.76)	1.28 (0.34–4.82)	0.795
	Primary	42 (65.6)	2.35 (1.20–4.57)	0.56 (0.19–1.64)	0.293
	Middle school	30 (47.6)	1.11 (0.58–2.14)	0.39 (0.15–1.04)	0.062
	Secondary and above	39 (37.3)	Reference	Reference	—
Education of father	Illiterate	26 (63.4)	4.57 (1.78–11.71)	4.19 (0.95–18.42)	0.057
	Primary	46 (73.0)	7.13 (2.93–17.30)	8.77 (2.19–35.13)	0.002
	Middle school	31 (55.4)	3.26 (1.36–7.81)	5.35 (1.48–19.32)	0.010
	Secondary	24 (48.0)	2.43 (1.36–7.81)	3.26 (1.17–9.11)	0.024
	Higher secondary and above	10 (25.0)	Reference	Reference	—
Occupation of father	Unskilled	61 (70.9)	3.92 (1.66–9.27)	1.57 (0.52–4.68)	0.415
	Semi-skilled	21 (38.9)	1.00 (0.40–2.49)	0.61 (0.20–1.81)	0.380
	Skilled	43 (55.1)	1.94 (0.83–4.54)	1.22 (0.45–3.35)	0.688
	Service and business	12 (38.7)	Reference	Reference	—
Family type	Nuclear	83 (69.2)	0.32 (0.19–0.55)	2.47 (1.37–4.46)	0.003
	Joint	55 (42.3)	Reference	Reference	—

*p-value < 0.05, considered as biologically plausible; **Binary logistic regression

association with inadequate awareness among the study population in current study.^{8,16} In this study, 53.6% of the study participants had adequate awareness of oral hygiene, 55.2% of them had unsatisfactory practice, whereas Bhuiyan et al. revealed that the participants had limited awareness and practice regarding oral hygiene.¹⁵

In a previous study in Hooghly, female gender [OR = 4.45 (2.37–8.34)], mothers' educational level below primary [OR = 1.78 (0.95–3.32)], were significantly associated with bad oral health among school-going adolescents of Hooghly district, West Bengal.¹² But the current study elicited female gender, nuclear family, and the education of father as sociodemographic characteristics having higher odds with unsatisfactory practice. About 62% of the study population took some educational training on oral hygiene from their parents, and 5.6% got the information from internet and social media and 66% of the respondents confirmed that they wanted more information to maintain proper oral hygiene. This showed their positive attitude toward oral hygiene and overall maintenance of good oral health.

CONCLUSION

Adolescents had adequate awareness of oral hygiene, but their practice was very unsatisfactory. While the education of mothers and occupation of fathers of the study population were found to be associated with inadequate awareness, female gender, education of fathers, and nuclear family were responsible for unsatisfactory practice. Social desirability bias could have influenced some of the responses of the study population. To overcome it, more information, education, and communication (IEC) programs should be carried out to increase awareness and improve the practice of oral hygiene among adolescents, especially in rural areas.

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Legal Considerations in India Surrounding Missed Anomaly Scan

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ABSTRACT

This study explores the legal and medical complexities surrounding missed fetal anomalies in second-trimester ultrasound scans, with a focus on whether such cases constitute medical negligence. The perspectives of 1,387 ultrasonologists were analyzed to understand professional opinions on missed diagnoses, for conditions such as spina bifida, limb reduction defects, and ventricular septal defects (VSD) during second-trimester ultrasound. A substantial proportion of respondents emphasized that missed anomalies should not automatically be considered negligence. Many professionals argued that diagnostic outcomes depend on uncontrollable factors, including patient conditions such as obesity, oligohydramnios, or twin pregnancies, and the inherent limitations of ultrasound technology. Contrary to these professional views, courts have frequently presumed negligence when congenital malformations go undetected during second-trimester ultrasounds, often awarding substantial compensation without considering the complexities of prenatal diagnostics. This disconnect between legal interpretations and medical practice has raised concerns about the fairness of judgments and their impact on the healthcare system. The survey results underscore the medical consensus that ultrasound cannot guarantee the detection of all fetal anomalies, challenging the assumption that missed diagnoses equate to professional misconduct or negligence. The study highlights the potential consequences of disproportionate compensation, such as escalating healthcare costs and reduced access to affordable ultrasound services for the broader population. Given that the cost of ultrasound procedures in India ranges from Rs. 500 to Rs. 1,500, large awards could burden healthcare providers, leading to increased costs and limiting diagnostic availability, which would negatively affect both patients and practitioners. This research calls for a more nuanced framework to assess medical negligence, one that distinguishes between genuine professional misconduct and the inherent limitations of a diagnostic technology. A balanced approach in legal adjudications would not only ensure accountability but also preserve the accessibility and affordability of essential prenatal care for millions of patients. The findings advocate for judicial decisions to be informed and taken after medical expert opinion, ensuring that justice serves both societal interests and the sustainability of healthcare services.

Keywords: Anomaly scans, Doctors, Legal, Ultrasound.

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INTRODUCTION

Ultrasound has played a critical role in reducing maternal mortality and perinatal mortality, especially in developing countries.¹ In the realm of prenatal care, anomaly scans are critical diagnostic tools that provide expectant parents and healthcare providers with crucial information about fetal development. Though conducted in all three trimesters, the second-trimester scans are most vital as these scans aim to identify congenital anomalies and assess the overall health of the fetus. Knowledge of an anomaly at an appropriate time theoretically gives the parents a chance to abort the baby as per the provisions of the Medical Termination of Pregnancy (MTP) Act.² However, when a healthcare provider fails to detect a significant anomaly during such a scan, the implications can be profound for the parents, leading to potential legal ramifications. The shock of finding a spina bifida in a newborn who had normal prenatal ultrasound scans can be devastating for parents, and their desire to blame someone is understandable. However, the law needs to be objective and not based on emotions. The intersection of medical negligence and legal accountability is a complex area that has garnered increasing attention in recent years.

Courts in India are, however, exceedingly eager to label missed diagnosis of congenital anomalies on obstetric ultrasound as negligence and very liberal in awarding compensations to complainants. A recent judgment by the National Consumer Dispute Redressal Commission in 2022³ is a case in point where

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a sum of Rs 1.25 crore was awarded to the complainant for limb abnormalities plus micrognathia with macroglossia, which were missed on repeated ultrasounds. The sympathy toward a victim with no leg below the knee is understandable. However, every injury in an accident causing disability is not due to the fault of the other party, and though the injured may need to be compensated by his insurer, the other party cannot always be held responsible and forced to pay the same.

The issue, however, is not only that the declaration of the ultrasonologist to be negligent causes damage to his/her professional reputation along with the huge quantum of

compensation burden, but also the fact that a number of cases alleging criminal negligence have also been filed on behalf of so-called victims as complaints to the police. These cases have then been referred to medical boards formed by local health authorities and local administration in accordance with the Jacob Mathew Judgment of the Honorable Supreme Court.⁴ The medical boards comprised of persons ignorant of the law are frequently at a loss as to what to say in their final report in such matters when they are confronted with a normal prenatal ultrasound report of a child born with obvious congenital anomalies. Lack of understanding of the components and consequences of findings of criminal negligence, civil negligence, error of judgment, misconduct, and a genuine mistake results in unnecessary confusion and harassment of doctors.

In the Supreme Court case of Poonam Verma vs Ashwin Patel and Ors.,⁵ the question of different types of negligence, including negligence per se, has been elaborated upon. But this legal distinction between negligence per se/civil and criminal negligence, also emphasized in the Jacob Mathew case,⁴ is unknown to the medical boards, so when the board opines that there is some negligence, the police automatically assume that it is criminal negligence.

Courts have also labeled missed congenital anomalies on ultrasound as *res ipsa loquitur* (meaning “the thing speaks for itself”),⁶ implying that the negligence is clear and obvious. Unfortunately, in doing so, the courts have erred on a few counts:

- The ideal way to check for defects is after the baby is delivered. Even then, a VSD (ventricular septal defect) may not be immediately obvious and can be missed. All imaging is just that—an image or a shadow—which can never compare to actual physical examination.
- The very definition of negligence and the *Bolam* test: This test compares the actions (whether omission or commission) of the doctor to what other reasonable practicing ultrasonologists would have done in the same situation. “The test is the standard of the ordinary skilled man exercising and professing to have that special skill. A man need not possess the highest expert skill; there may be one or more perfectly proper standards, and if he conforms with one of these proper standards, then he is not negligent.”⁷ This decision has been approved by the House of Lords.^{8–10}
- Actionable negligence: For negligence to be actionable, the accused’s act should have resulted in harm. It is common sense that the ultrasonologist did not cause the congenital anomaly.
- Additionally, at 20 weeks of gestation, the fetal limbs are only 2.5–3 inches long, and the sonologist examines these tiny parts using 2D sonography rather than 3D imaging. It is a well-accepted legal principle that decisions should not be based on what is known at the time of trial but rather on what was known at the time of the event.

The *standard of care* is a legal term, not a medical one. It refers to the degree of care a prudent and reasonable person would exercise under the circumstances.¹¹ When an anomaly is missed, the question arises as to whether the healthcare provider adhered to this standard. Under the Consumer Protection Act of 1986 and 2019, this is often assessed in a summary fashion, without expert testimony or comparative analysis of medical practices. It would be different if multiple scans had been conducted by different ultrasonologists during the second

trimester, showing differing findings. However, comparing postnatal findings with prenatal ultrasound from the second trimester is overly simplistic.

The legal consequences of missed anomaly scans vary by jurisdiction, reflecting different legal interpretations and precedents. In some regions, courts have recognized the right to seek damages for emotional distress resulting from the failure to detect anomalies. In others, the focus remains primarily on the physical health outcomes for the child.¹² These disparities highlight the need for a comprehensive understanding of both legal frameworks and medical practices.

Although the judiciary has yet to recognize the distinctions, obstetric ultrasonologists categorize ultrasound procedures into three levels:

1. *Routine obstetric ultrasound for fetal well-being (ROUFW)*: This level focuses on assessing fetal growth and cardiac activity.
2. *Level 2 ultrasound (L2U)*: Also known as an anomaly scan or fetal anatomical survey, this detailed ultrasound is typically conducted between 18 and 23 weeks of gestation. It offers a more comprehensive evaluation of fetal development than standard ultrasounds.
3. *Fetal echocardiography (FE)*: This specialized ultrasound identifies significant structural anomalies in the fetal heart. Medical professionals acknowledge that what may be considered negligence in FE need not be negligence in ROUFW. Unfortunately, courts tend to evaluate all obstetric ultrasounds on the same scale.

False negatives in ROUFW, L2U, and FE are common worldwide. The detection rate for spina bifida is only 68%, and for atrioventricular septal defect (AVSD), it is 42%.^{13,14} When considering the legal implications of missed anomaly scans, it is important to assess not only the direct consequences for the child but also the broader effects on healthcare providers and the healthcare system as a whole. Increased litigation for compensation and criminal prosecution may lead some practitioners to practice defensive medicine, which can further strain healthcare resources and affect patient care.¹⁵ This raises ethical considerations about balancing protection for medical professionals with ensuring high-quality patient care.

To declare an ultrasonologist negligent, ideally, other fetal ultrasonologists, unaware of the postnatal outcome, should review the films and video records from the time of the alleged negligence. If all ultrasonologists agree that the anomaly was visible in the second-trimester ultrasound, negligence may be upheld. However, if there was a divergent opinion or if the experts disagree, it should not be labeled as negligence. If there are two responsible schools of thought for a given situation, courts could do a great disservice by placing the hallmark of legality on one.¹⁶

In India, the MTP Act permitted termination of pregnancy up to 20 weeks, now extended to 24 weeks of gestation. Since negligence on the ultrasonologist’s part did not cause the congenital anomaly, compensation arguments focus on the lost opportunity for parents to abort the fetus if the anomaly had been detected. The question remains: What level of limb defects, VSD size, or grade of spina bifida would justify the right to abort? If a significant number of fetal ultrasound practitioners believe an anomaly can be missed despite careful examination, and the accused’s actions do not constitute negligence, courts

would do an injustice by declaring the ultrasonologist negligent. Identifying problems from ultrasound images is both an art and a science, and it is far from perfect.

Ultimately, the discussion surrounding the law and missed anomaly scans requires an interdisciplinary approach, combining medical ethics, legal theory, and healthcare policy. By analyzing case law, expert opinions, and emerging trends in medical technology, stakeholders can better understand the complexities involved and work toward improving legal and healthcare outcomes.

INTERNATIONAL LITERATURE REVIEW

McLachlan has highlighted significant variations in the standard of care across jurisdictions, indicating that expert testimony is crucial for determining negligence in cases involving missed anomalies.¹⁷ Brown, in a paper entitled *"The Implications of Defensive Medicine in Obstetrics: A Legal and Ethical Analysis,"* discusses how fear of litigation affects obstetricians' practices, leading to increased defensive medicine, which may not always benefit patient care.¹⁵ Jones, in paper *"Emotional Distress and Medical Malpractice: A Review of Case Law Surrounding Missed Anomaly Scans"* reveals that courts have increasingly recognized emotional distress claims, providing grounds for parents to seek damages beyond physical health outcomes.¹² Smith, in the paper *"Technological Advancements in Prenatal Imaging: Legal Implications for Practitioners,"* argues that advancements in imaging technology raise expectations of healthcare providers, necessitating ongoing education and adaptation to prevent legal repercussions.¹⁸ Similarly, the green in the published work *"Missed Diagnoses in Prenatal Care: Legal and Ethical Considerations"* review outlines the ethical obligations of practitioners and the potential legal consequences of missed diagnoses, emphasizing the need for comprehensive consent processes.

A 2005 publication from Liverpool Women's Hospital raised the question, "Is it always negligent to miss a small open lumbosacral spina bifida (below L3) at a routine 20-week scan without extenuating circumstances (obesity, oligohydramnios)?" Approximately 62% of their expert panel stated that it is not negligent to miss such a lesion. A further 24% said that it was not negligent to miss small spina bifida, provided there is documented evidence of normal intracranial anatomy (absence of head signs). Only 4/29 experts felt that such an anomaly should always be detected. Is it always negligent to miss an average-sized AVSD that requires surgical closure at a routine 20-week scan without extenuating circumstances (obesity, oligohydramnios)? Some 79% of experts felt that an AVSD could be missed by a competently performed ultrasound examination.¹⁹

In a prospective study, details of 3,685 fetuses with congenital structural abnormalities were recorded from an unselected population of women who underwent routine ultrasound examination during their pregnancies. Overall, 2,262 fetuses were diagnosed as being abnormal before birth (sensitivity = 61.4%). The total number of abnormalities was 4,615, of which 1,733 (37.5%) were major abnormalities. The overall number of detected abnormalities was 2,593 (sensitivity = 56.2%). If only major abnormalities were considered, the sensitivity rose to 73.7%, compared to only 45.7% for the minor abnormalities. Within each severity group, the accuracy of detection varied across systems. For the major abnormalities, it was higher for

the central nervous system (88.3%) and urinary tract (84.8%), but lower for the heart and great vessels (38.8%). Detection of minor abnormalities was also effective for the urinary tract (89.1%), but not for the heart and great vessels (20.8%) and the musculoskeletal system (18%).²⁰ Another study quotes that ultrasound gave a positive result in only 46% of cases of chromosomal anomalies with maternal age 35 years.²¹

In a recent study, van Nisselrooij et al. took 114 cases of severe congenital heart disease (defined as those requiring surgery within the first year of life) and did a retrospective study to find that 58 of them were missed on a standard anomaly scan done in the second trimester. The defects comprised transposition of the great arteries (17%), aortic coarctation (16%), tetralogy of Fallot (10%), atrioventricular septal defect (6%), aortic valve stenosis (5%), ventricular septal defect (18%), and other defects (28%).²²

METHODOLOGY

Medicolegal Action Group organized a survey on the issue, focusing on ROUFW, L2U, and FE done at 18–22 weeks of gestation. In order to gather some tangible information on the matter, the authors used the SurveyMonkey platform to create a 15-question survey that was sent out to doctors all over India via email, Facebook, and WhatsApp.

RESULTS

A total of 1,387 ultrasonologists responded to the survey. Of which 609 (43.94%) were MD Radiology, 231 (16.67%) were DMRD, 437 (31.53%) were MD/MS (obstetrics and gynecology), and 109 (7.86%) were MBBS, one respondent did not mention his qualification (Fig. 1).

Of the 1,387 responders, 879 (63.42%) were individual practitioners, 207 (14.94%) were affiliated with a corporate hospital, 110 (7.94%) were working in a tertiary government institute and 86 (6.2%) in a government hospital. 104 (7.5%) respondents were working in settings different from these (e.g., Charitable Trust Hospitals and diagnostic centers) (Fig. 2).

A total of 314 (22.72%) responders had experience of less than 5 years in obstetric ultrasound, 262 (18.96%) had experience between 5 and 10 years, 273 (19.75%) between 10 and 15 years, 204 (14.76%) between 15 and 20 years, and 329 (23.81%) with more than 20 years of experience. Five responders did not give an answer to this question (Fig. 3).

To our question: Whether a ROUFW could pick up all fetal anomalies and guarantee a healthy baby, 99.35% of respondents said that an ROUFW cannot pick up all anomalies. 98.84% of respondents said that even an L2U cannot guarantee a healthy baby. These results reflect a strong consensus among 1,387 professionals, suggesting that routine (ROUFW) or advanced ultrasound (level 2) is not foolproof in detecting fetal anomalies. These findings could indeed be persuasive if presented in legal or policy-making settings (Figs 4 to 7).

The overwhelming majority answered "No," indicating that they do not believe ROUFW and L2U both can detect all fetal anomalies or guarantee a healthy baby. The calculated *p*-value for each was extremely small (much smaller than common significance levels such as 0.05 or 0.01), confirming that this difference is statistically significant, and there is strong evidence against the idea that respondents are equally divided on the issue. This suggests a

WHAT IS YOUR QUALIFICATION ?

Answered: 1,386 Skipped: 1

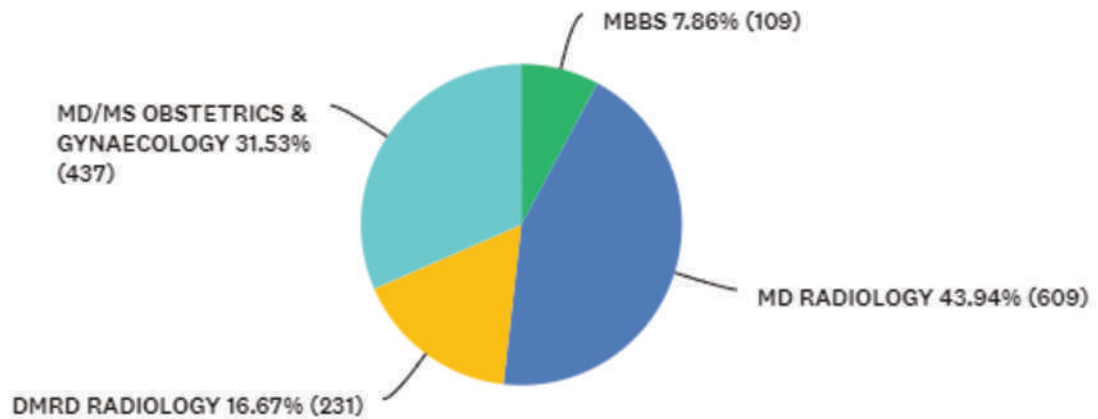


Fig. 1: Qualification of respondents

WHAT IS YOUR AFFILIATION ?

Answered: 1,386 Skipped: 1

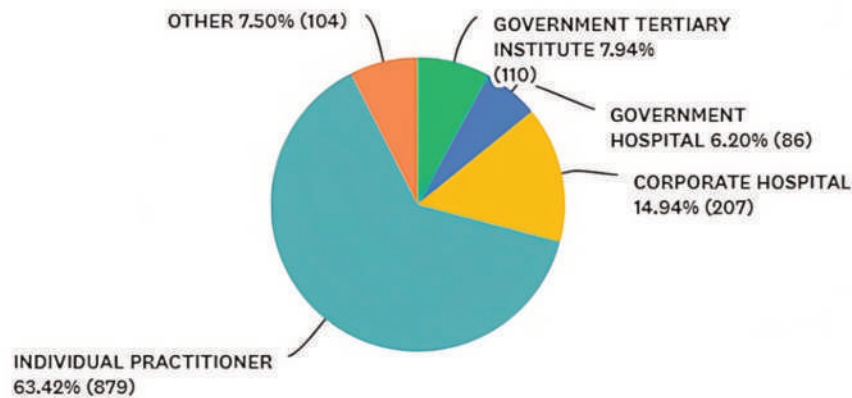


Fig. 2: Affiliation of respondents

prevailing consensus that both ROUFW and L2U have limitations in fully assessing fetal health.

To our question: As to what should missing an anomaly on a detailed ultrasound scan be considered:

A total of 1,387 respondents provided their opinions. The breakdown of responses is as follows:

- 1 respondent (0.07%) considered it as criminal negligence.

- 59 respondents (4.26%) indicated that missing an anomaly fulfills the criteria for civil negligence, warranting compensation.
- 99 (7.15%) respondents perceived it as misconduct that should be addressed by the medical council.
- 417 (30.13%) respondents classified it as an error of judgment, stating that the institution should implement measures to prevent recurrence.

WHAT IS YOUR EXPERIENCE IN THE FIELD OF OBSTETRIC ULTRASOUND ?

Answered: 1,382 Skipped: 5

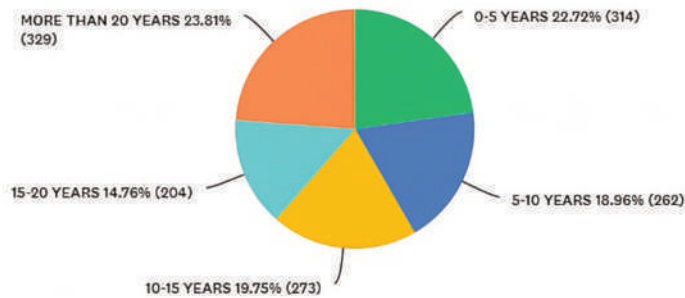


Fig. 3: Experience of respondents

CAN ROUTINE OBSTETRIC ULTRASOUND DONE FOR FETAL WELL BEING PICK UP ALL FETAL ANOMALIES AND GUARANTEE A NORMAL HEALTHY BABY ?

Answered: 1,383 Skipped: 4



Fig. 4: Routine obstetric ultrasound for fetal well-being

CAN A ROUTINE LEVEL2 ULTRASOUND PICK UP ALL FETAL ANAMOLIES AND GUARANTEE A HEALTHY BABY WITH NO DEFECTS IS BORN ?

Answered: 1,384 Skipped: 3

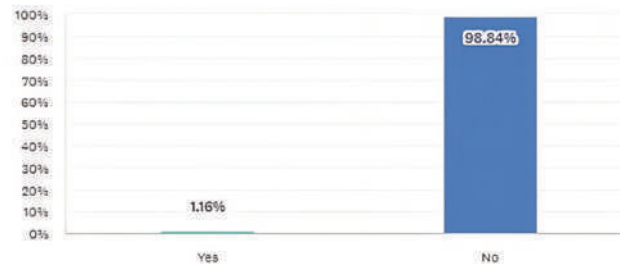


Fig. 5: Level 2 ultrasound

- 235 respondents (16.98%) felt it should be viewed as a mistaken diagnosis, necessitating introspection by the ultrasonologist to avoid repetition.
- 573 respondents (41.4%) responded that missing an anomaly is an inherent risk of technology and does not warrant action against the ultrasonologist.
- Did not answer this question.
- Among respondents employed in tertiary care government institutes, approximately 96.36% do not consider missing an anomaly on a detailed ultrasound as criminal or civil negligence.

MISSING AN ANAMOLY EVEN ON MOST ON DETAILED OBSTETRIC ULTRASOUND SHOULD BE CONSIDERED

Answered: 1,384 Skipped: 3

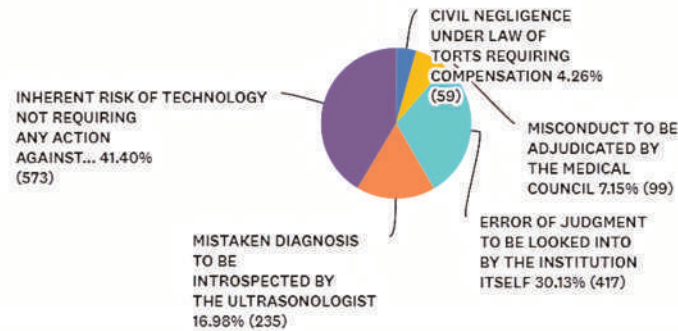


Fig. 6: Total respondents

MISSING AN ANAMOLY EVEN ON MOST ON DETAILED OBSTETRIC ULTRASOUND SHOULD BE CONSIDERED

Answered: 838 Skipped: 2

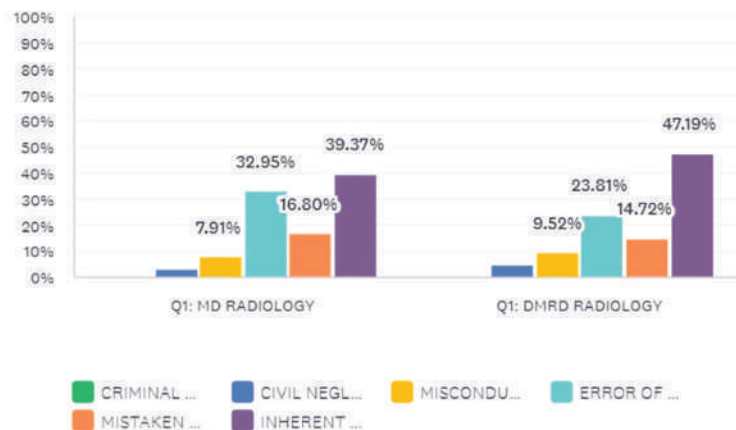


Fig. 7: Radiologists

- Among the gynecologists, 94.97% indicated that failure to detect a fetal anomaly does not qualify as criminal or civil negligence.
- Among the radiologists, 92.33% echoed a similar sentiment, affirming that failure to identify a fetal anomaly does not constitute criminal or civil negligence.

Perceptions of Negligence in Missed Anomalies

A substantial majority of respondents (95.39%) indicated that distinct criteria should be utilized when assessing negligence for missed anomalies across the different ultrasound levels: ROUFW, L2U, and FE.

Factors Influencing Negligence Assessment

In evaluating the potential negligence of an ultrasonologist in cases where anomalies are missed, other factors—such as obesity, oligohydramnios, and multiple pregnancies—may play a critical

role. A noteworthy 96.1% of respondents concurred that different assessment criteria should be applied in the context of associated conditions such as obesity, oligohydramnios, and multiple gestations when determining alleged negligence (Figs 8 and 9).

The perceptions of respondents regarding the implications of missing a ventricular septal defect (VSD), limb reduction defects, and spina bifida during different ultrasound examinations were analyzed. The results are summarized below:

Whether a VSD not picked up on fetal echocardiography done in the second trimester should be considered negligence was answered with 2.74% of respondents felt that missing a VSD on fetal echocardiography should be classified as negligence on the part of the fetal echocardiographer. 41.53% considered it an error of judgment but not negligence. 31.58% did not believe it amounted to negligence under any circumstance. 24.15% felt that the determination of negligence should take into account

MISSING AN ANAMOLY EVEN ON MOST ON DETAILED OBSTETRIC ULTRASOUND SHOULD BE CONSIDERED

Answered: 437 Skipped: 0

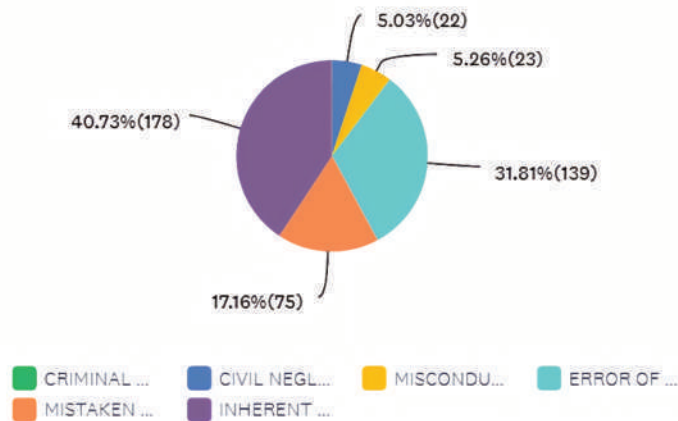
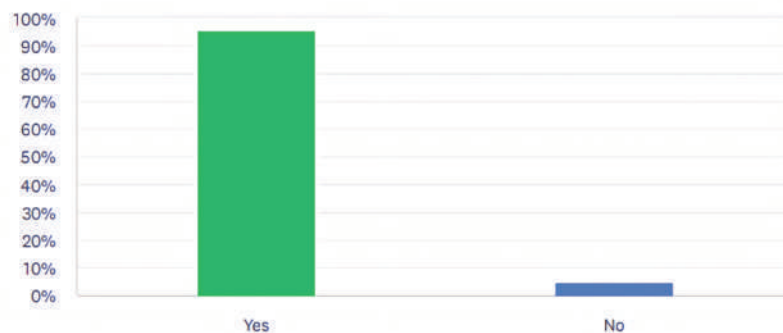


Fig. 8: Obstetricians and gynecologists

Q2 DIFFERENT YARDSTICKS SHOULD BE USED WHEN ASSESSING NEGLIGENCE IN A) ROUTINE SCAN FOR FETAL WELL BEING , B) LEVEL 2 SCAN AND C) FETAL ECHOCARDIOGRAPHY .

Answered: 1,387 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	95.39%	1,323
No	4.61%	64
TOTAL		1,387

Fig. 9: Respondents support using different yardsticks for assessing negligence across scan types

whether the patient had associated conditions such as obesity, twin pregnancy, or oligohydramnios (Fig. 10).

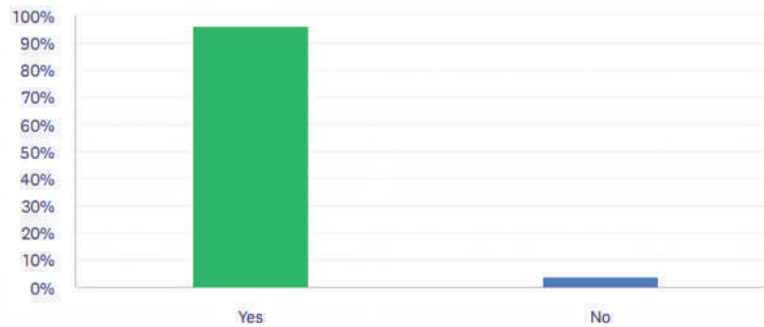
To the question whether or not a missed VSD on a level 2 scan should be considered negligence, only 3.2% of respondents believed that missing a VSD on a level 2 scan should be considered negligence. However, 38% responded that it should not be considered negligence regardless of the circumstances. 25.16% felt

that associated factors such as oligohydramnios, twin pregnancy, and obesity should be taken into account when deciding on negligence. 33.60% stated that it should be regarded as an error of judgment, but not negligence (Fig. 11).

To the question of whether missing a VSD on ROUFW, of the 1,387 respondents, only 0.87% of respondents believed that missing it should be considered negligence. 79.52% felt there was

Q3 DIFFERENT YARDSTICKS SHOULD BE USED WHEN DECIDING ON NEGLIGENCE IN A) NORMAL PREGNANCY B) OBESITY C) OLIGOHYDRAMNIOS D) TWINS

Answered: 1,386 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	96.10%	1,332
No	3.90%	54
TOTAL		1,386

Fig. 10: Respondents on using different yardsticks to decide negligence in varied pregnancy conditions

IS MISSING A VSD WHICH LATER REQUIRES SURGERY ON FETAL ECHOCARDIOGRAPHY NEGLIGENCE ?

Answered: 1,387 Skipped: 0

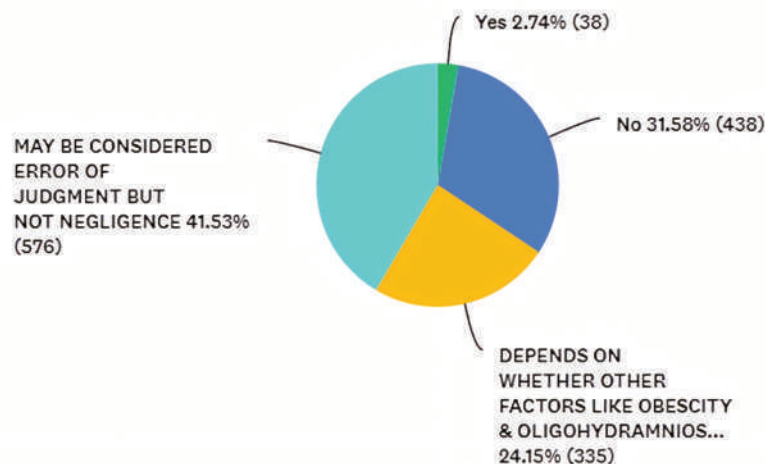


Fig. 11: Ventricular septal defect (VSD) on fetal echocardiography

no negligence whatsoever. 12.62% thought it could be an error of judgment but not negligence, while 6.99% opined that the presence of associated factors such as obesity and oligohydramnios should be taken into account before determining negligence (Fig. 12).

Among respondents, 22.15% considered it negligence if spina bifida was missed on a level 2 scan, while 12.05% believed

it would not amount to negligence under any circumstances. A significant proportion (42.35%) stated that whether it constituted negligence would depend on associated factors such as obesity or oligohydramnios. Additionally, 23.45% regarded it as an error of judgment rather than negligence (Fig. 13).

IS MISSING A VSD ON LEVEL 2 SCAN NEGLIGENCE ?

Answered: 1,387 Skipped: 0

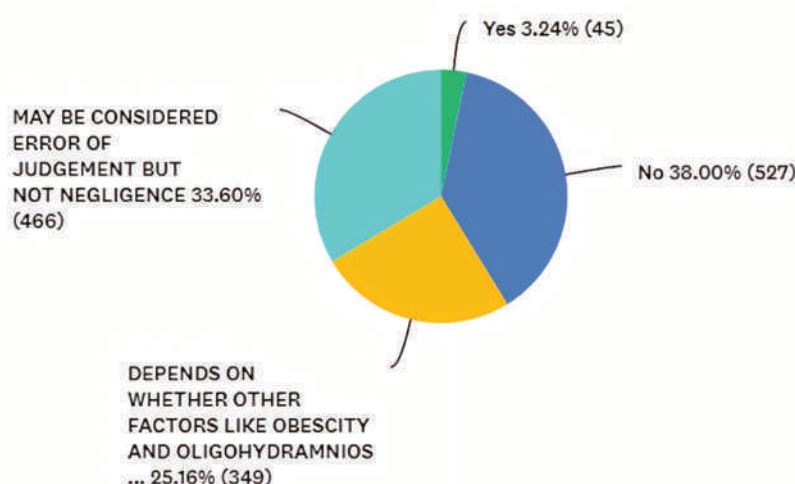


Fig. 12: Ventricular septal defect (VSD) on level II scan

IS MISSING A VSD ON ROUTINE SCAN DONE FOR FETAL WELL BEING NEGLIGENCE ?

Answered: 1,387 Skipped: 0

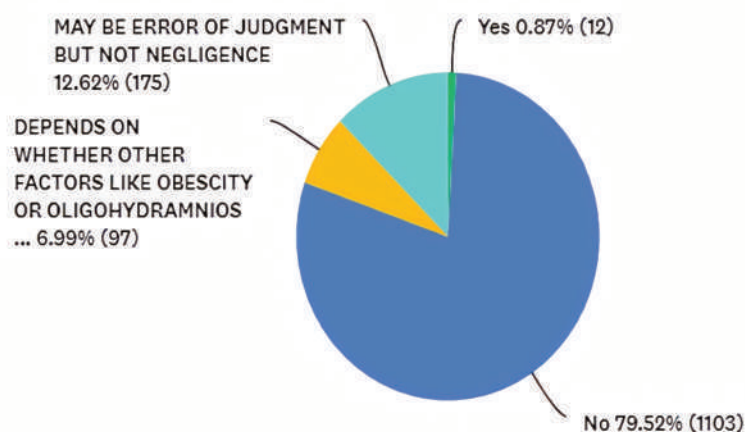


Fig. 13: Ventricular septal defect (VSD) on routine ultrasound for fetal well-being

On the other hand, only 8.3% believed that missing spina bifida on a routine obstetric scan for fetal well-being amounted to negligence. The majority (53.46%) opined that the operator was not

negligent if the condition was missed during a routine scan, while 23.09% felt that associated factors should be considered when assessing negligence. Finally, 15.15% categorized it as an error of

IS MISSING SPINA BIFIDA ON LEVEL 2 SCAN NEGLIGENCE ?

Answered: 1,386 Skipped: 1

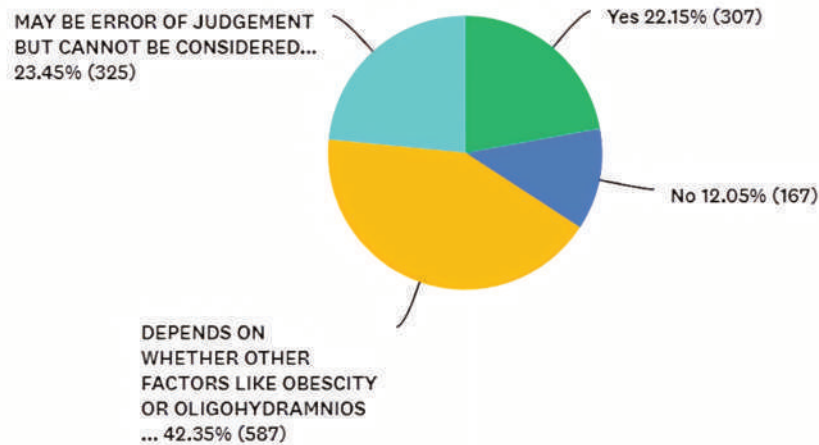


Fig. 14: Spina bifida on level 2 scan

IS MISSING SPINA BIFIDA ON ROUTINE OBSTETRICS SCAN DONE FOR FETAL WELL BEING NEGLIGENCE ?

Answered: 1,386 Skipped: 1

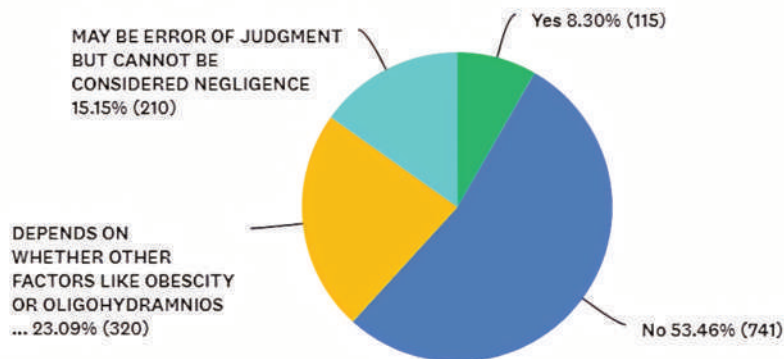


Fig. 15: Missing spina bifida on routine obstetrics

judgment but not negligence, reinforcing the diverse opinions on the implications of missed diagnoses across different ultrasound levels and contexts (Fig. 14).

When asked about the implications of missing limb reduction defects on an L2U, 30.06% of respondents classified it as negligence, while 10.53% indicated it would not constitute negligence. A larger portion, 42.03%, believed that the determination of negligence would depend on associated factors such as obesity, oligohydramnios,

and twin pregnancy. Additionally, 17.38% considered it an error of judgment rather than negligence (Figs 15 and 16).

In the context of a routine obstetric ultrasound, 8.03% of respondents regarded missing limb reduction defects as negligence, while 53.72% felt there was no negligence. 25.02% stated that whether negligence applied depended on associated factors. Finally, 13.23% categorized it as an error of judgment rather than negligence. This distribution highlights the variability in

IS MISSING A LIMB REDUCTION DEFECT ON LEVEL 2 ULTRASOUND NEGLIGENCE ?

Answered: 1,387 Skipped: 0

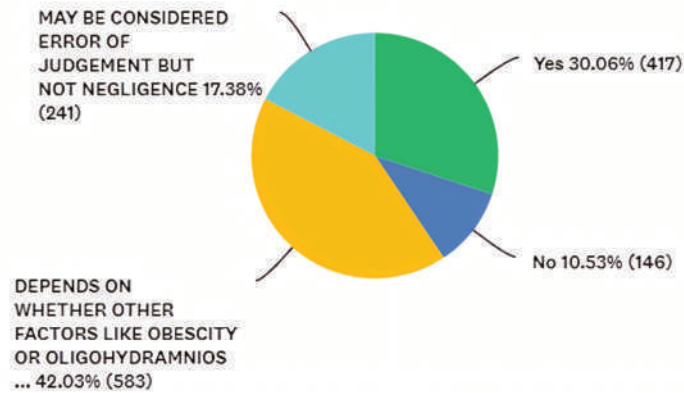


Fig. 16: Missing limb reduction defects

IS MISSING A LIMB REDUCTION DEFECT ON ROUTINE OBSTETRICS ULTRASOUND FOR FETAL WELL BEING NEGLIGENCE ?

Answered: 1,383 Skipped: 4

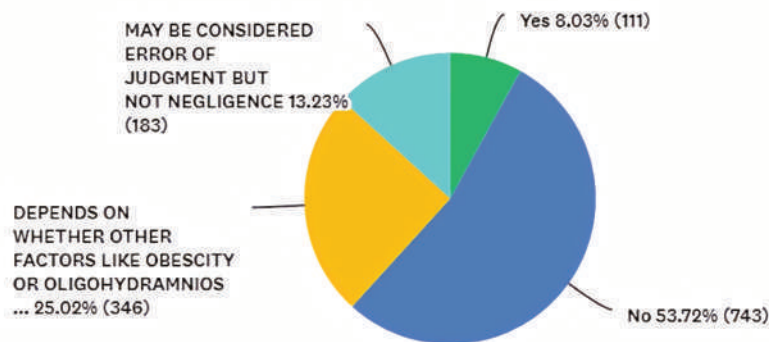


Fig. 17: Routine obstetric ultrasound

opinions about the role of ultrasound type and contextual factors in assessing professional accountability. (Fig. 17)

CONCLUSION

The findings highlight the nuanced perspectives of medical professionals regarding the limitations and expectations of prenatal ultrasound, particularly for second-trimester scans. A significant proportion of ultrasonologists believe that missing certain anomalies, such as spina bifida, limb reduction defects, or VSD, should not automatically be classified as negligence. Instead, many professionals argue that missed diagnoses may often be attributed to factors beyond the operator's control, such as patient

conditions (e.g., obesity, oligohydramnios, or twin pregnancies) and the inherent limitations of ultrasound technology.

In contrast, legal interpretations have often presumed negligence whenever a congenital anomaly goes undetected in a second-trimester ultrasound, potentially disregarding the complexities recognized by medical experts. The overwhelming consensus from the surveyed 1,387 ultrasonologists is that ultrasounds cannot detect all fetal anomalies with certainty, raising questions about whether judicial rulings reflect a comprehensive understanding of the diagnostic process.

The awarding of large compensations without nuanced consideration of whether true negligence occurred may have broader implications, such as driving up healthcare costs and

limiting access to essential diagnostic services. Given the relatively affordable cost of ultrasound procedures in India (ranging from Rs. 500 to Rs. 1,500), disproportionate penalties could burden the healthcare system, negatively impacting both providers and patients. A more balanced approach is needed—one that distinguishes between genuine negligence and the inherent risks of diagnostic limitations. Such a framework would ensure that accountability serves the interests of justice without compromising the accessibility and affordability of essential prenatal care for millions of patients across India.

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Prevalence of Serum Testosterone Deficiency in Type 2 Diabetes Mellitus

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ABSTRACT

Background: In India, the escalating prevalence of type 2 diabetes mellitus (T2DM) presents a major public health challenge. Given the potential impact of hormonal imbalances on diabetes outcomes, this study aims to explore the prevalence of serum testosterone deficiency in individuals with T2DM in the Indian population, contributing to a nuanced understanding of the disease spectrum.

Materials and methods: In this study, a cohort of 100 male patients aged 30 years or older, diagnosed with T2DM for at least 1 year, was selected. Patient histories were gathered using a comprehensive questionnaire encompassing baseline characteristics relevant to the illness. The ADAM questionnaire was specifically administered to individuals for whom hypogonadism was suspected.

Results: The study revealed a notable occurrence of low testosterone levels in patients diagnosed with T2DM. The prevalence of low testosterone was found to 17% of all diabetic participants. Analysis of gonadotropins indicated that hypogonadotropic hypogonadism was the predominant type, with no observed correlation between the degree of hyperglycemia and testosterone levels.

Conclusion: This study contributes to the growing body of knowledge surrounding the intricate interplay between hormonal status and type 2 diabetes by concluding that the endogenous testosterone and its binding protein, SHBG, undergo alterations dependent on T2DM, holding clinical significance. Our assessment of testosterone and SHBG underscores their utility in predicting the risk and is crucial for a comprehensive approach to patient care. Addressing hypogonadism emerges not only as a means to enhance glucose control but also as a pathway to improve overall sexual health.

Keywords: Hypogonadism, Sex hormone-binding globulin, Testosterone, Type 2 diabetes mellitus.

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INTRODUCTION

Economic development and urbanization globally shift health concerns from communicable to noncommunicable diseases (NCDs), with diabetes at the forefront. This pandemic spans developed and developing countries, posing a substantial worldwide challenge. In India, diabetes prevalence is surging from 40.6 million in 2006 to an estimated 79.4 million by 2030. Type 2 diabetes mellitus (T2DM), marked by insulin resistance, imposes a significant social and economic burden on healthcare systems. Diabetes complications contribute to heightened morbidity and mortality, encompassing irreversible microvascular and macrovascular effects. Asian Indians exhibit a specific phenotype linked to increased predisposition to diabetes and premature coronary artery disease. Low testosterone levels are recognized as connected to insulin sensitivity and T2DM.¹

Hypogonadism, a microvascular complication of diabetes, includes vasculopathy, neuropathy, and endocrine disorders. Studies suggest psychogenic factors contribute to erectile dysfunction in hypogonadism, a condition characterized by both clinical and biochemical reductions in testosterone levels.² Various factors contribute to low testosterone levels in T2DM. Firstly, there is reduced production of sex hormone-binding globulin (SHBG), a crucial carrier protein synthesized in the liver for circulating testosterone. Additionally, visceral obesity in diabetic individuals plays a role as it converts testosterone to estradiol through the enzyme aromatase in adipose tissue. This process, in turn, contributes to a cycle of increased fat accumulation and worsening testosterone deficiency.^{1,3,4}

Testosterone exists in three main forms: free, albumin-bound, and sex hormone-binding globulin (SHBG)-bound. SHBG predominates, comprising 60–80% of the total. Free and

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albumin-bound testosterone collectively form non-SHBG-bound testosterone, the biologically active component readily available in tissues. In contrast, SHBG is tightly bound and inactive. Low testosterone correlates with insulin sensitivity and resistance, with a two to three times higher risk of cardiovascular disease. Diabetic neuropathy can manifest as erectile dysfunction and reverse ejaculation. The prevalence of erectile dysfunction increases with age and illness duration, occasionally occurring in the absence of signs in diabetic autonomic neuropathy.⁵ Hypogonadism significantly contributes to erectile dysfunction, with varying prevalence among diabetic patients in different studies.^{6–11}

Dhindsa et al.,¹² in 2004, pioneered the measurement of free testosterone in T2DM, a finding later corroborated by Kapoor et al.³ and subsequent studies. They observed that individuals with T2DM have testosterone levels twice as low as nondiabetic individuals. Hypogonadism, in consequence, amplifies lipid mass, accelerates bone loss, diminishes muscle mass, heightens bone fracture risk,

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reduces libido, and contributes to erectile dysfunction. Moreover, testosterone exhibits anti-inflammatory and antiatherosclerosis properties, potentially exacerbating other complications associated with diabetes.⁹ Diminished testosterone levels serve as an independent risk factor for diabetes, exacerbating the control of glycemic levels.^{10–13}

MATERIALS AND METHODS

The research was conducted at the Department of General Medicine, Vinayaka Mission's Kirupananda Variyar Medical College, Salem, Tamil Nadu, India. It employed a cross-sectional study design for a period of 1 year. 100 individuals with T2DM who were willing to participate in the study were included. Inclusion criteria comprised males over 30 years diagnosed with diabetes mellitus for more than 1 year. Exclusion criteria included females and patients with specific conditions or medications affecting testosterone levels. The study procedure obtained necessary approvals, recruiting patients in the medicine and diabetic OPD, and data collection involved a semistructured pretest questionnaire, encompassing baseline characteristics and an ADAM questionnaire to assess hypogonadism. Investigations covered anthropometric measurements and various laboratory parameters, including fasting and postprandial blood sugar, HbA1c, lipid profile, Follicle-stimulating hormone, luteinizing hormone, sex hormone-binding globulin, and free testosterone. Statistical analysis involved data entry into Microsoft Excel and subsequent analysis in SPSS version 27. Descriptive statistics, including mean, standard deviation, median, and interquartile range, were employed for continuous variables, while categorical data were presented as proportions. The chi-square test and logistic regression were used as tests of significance, with *p*-values less than 0.05 considered statistically significant.

RESULTS

The examination of low testosterone prevalence in our study unveiled a notable occurrence, with 17% of participants exhibiting low testosterone levels. The mean age of the study participants was determined to be 50.39 ± 12.31 , spanning from 31 to 75 years, reflecting a diverse age range within the cohort. Notably, the majority of low testosterone cases (16%) were concentrated in the age group of 30–39 years, suggesting a specific vulnerability during this phase of adulthood. The mean value of the low testosterone group stood at 189 ± 120.2 , indicating a noteworthy departure from the expected norm. In terms of body mass index (BMI), a critical health metric, the study uncovered a mean BMI of 25.9 ± 4.1 in the low testosterone group, surpassing that of the normal testosterone group. This disparity was not only apparent but also statistically significant, underlining the association between low testosterone and increased BMI. Lifestyle factors also played a role, with 14% of participants in the low testosterone group reporting a smoking habit, adding a behavioral dimension to the investigation. Moreover, 8% of the study participants with low testosterone had a documented history of alcohol consumption, introducing another layer of complexity to the observed correlations. Analyzing the hormonal aspect, the mean testosterone level in the low testosterone group was 189 ± 120.2 , diverging significantly from the normal testosterone group. This difference was not only pronounced but also deemed statistically significant, underscoring the impact of testosterone deficiency on the endocrine profile. Cholesterol levels further delineated

distinctions between the groups, with the mean cholesterol level in the low testosterone group measuring 181.15 ± 35.5 , lower than that of the normal testosterone group. Conversely, the mean high-density cholesterol (HDL) was higher in the low testosterone group, registering at 8.98 ± 4.5 . Delving into specific lipid components, the mean low-density lipoprotein cholesterol (LDL) in the testosterone-deficient group was 109.72 ± 38.11 , which was lower than that in the normal testosterone group. Hormonal regulators, such as follicle-stimulating hormone, showed elevated levels in the testosterone-deficient group, with a mean of 7.9 ± 3.9 , compared with the normal testosterone group. The mean luteinizing hormone, however, displayed a converse relationship, registering a higher value in the testosterone-deficient group (7.28 ± 3.5) compared to the normal testosterone group (6.34 ± 3.03). Finally, the mean sex hormone-binding hormone was recorded at 34.37 ± 15.12 , lower than that of the normal testosterone group, signifying a distinctive hormonal milieu in the context of testosterone deficiency. Overall, these findings illuminate the intricate interplay between testosterone levels, physiological markers, and lifestyle factors, offering valuable insights into the multifaceted aspects of male health (Tables 1 and 2).

DISCUSSION

Metabolic disturbances in carbohydrates, proteins, and lipids give rise to systemic complications and comorbidities, notably cardiovascular and renal complications. The global burden of diabetes mellitus is staggering, with over 300 million people affected, a number expected to double to 600 million by 2035. This escalating prevalence of diabetes has not only contributed to widespread health concerns but has also been linked to a decrease in fertility, particularly in men within the reproductive age group. Male hypogonadism, characterized by both symptomatic manifestations and low testosterone levels at the biochemical level, becomes increasingly prevalent with age. As men age, testosterone deficiency and androgen deficiency tend to occur. The rise in diabetes cases, particularly in the context of metabolic syndrome and obesity, has been associated with diminished levels of free and total testosterone.¹⁴ The Rancho Bernardo¹⁵

Table 1: Demographic profile of the patients

Description	Variables	Values
Age	Mean $\pm$ SD	50.39 ± 12.31
	Range	31–75 years
	>50 years	48
	<50 years	52
Gender	Male	100
Educational status	Literate	66
	Illiterate	34
Marital status	Married	68
	Unmarried	27
	Widow and Widower	5
Addiction	H/O smoking	90
	H/O alcohol	83
Mean body mass index (BMI)	Normal	16
	Overweight	38
	Obese	46
Testosterone	Low	17
	Normal	83

Values are in mean $\pm$ SD

Table 2: Findings noted in individuals with both low and normal testosterone levels

Description	Serum testosterone	Values	p-value
Body mass index (BMI)	Low	25.9 ± 4.1	0.001 (S)*
	Normal	22.6 ± 3.7	
Testosterone	Low	189 ± 120.2	0.001 (S)**
	Normal	192.2 ± 109.4	
Cholesterol level	Low	181.05 ± 35.5	0.03 (S)**
	Normal	202.8 ± 49.2	
High-density lipoprotein (HDL)	Low	8.98 ± 4.57	0.01 (S)**
	Normal	6.57 ± 3.46	
Low-density lipoprotein (LDL)	Low	109.72 ± 38.11	0.5**
	Normal	115.83 ± 33.82	
Follicle-stimulating hormone (FSH)	Low	7.9 ± 3.9	0.01 (S)**
	Normal	5.7 ± 3.0	
Luteinizing hormone (LH)	Low	7.28 ± 3.5	0.1**
	Normal	6.34 ± 3.03	
Sex hormone binding globulin (SHBG)	Low	34.37 ± 15.12	0.7**
	Normal	36.04 ± 17.25	

*p-value according to one-way analysis of variance; **p-value according to Student's t-test; values are in mean ± SD; significance level (S) < 0.05

study, focusing on older patients with T2DM, revealed a notable prevalence of low testosterone levels in this demographic. Examining baseline characteristics, it becomes evident that microvascular complications of diabetes contribute to the occurrence of low testosterone. Vasculopathy and endocrine imbalances further exacerbate the issue in T2DM. In our study, the prevalence of hypogonadism stood at 17%, a figure deviating from the 40% reported in a study by Madhu et al.² among T2DM patients. Age plays a crucial role in testosterone dynamics, witnessing a decline as individuals progress through the years. The mean age of our study participants, 50.39 ± 12.31, aligns with findings from studies conducted by Afkhamizadeh et al.¹⁶ and Al Hayek et al.,¹⁴ emphasizing the consistency of age-associated decreases in testosterone levels. With sexual function in males diminishing with age, this decline in testosterone may have origins in both hypothalamic-pituitary and testicular factors. In our study, nearly half of the patients belonged to the middle-aged group. BMI emerges as a significant factor influencing testosterone levels, with the testosterone-deficiency group displaying a mean BMI of 25.9 ± 4.1, higher than the normal testosterone group. Numerous studies have highlighted the association between BMI and low serum testosterone, with obesity consistently linked to a higher prevalence of low testosterone, adding to overall health risks. The interplay between testosterone, obesity, and cardiovascular risks is intricate, emphasizing the multifaceted nature of these relationships. Smoking, lifestyle choices, and lipid levels also factor into the comprehensive understanding of hypogonadism in the context of diabetes. Our study showed that 14% of participants with low testosterone had a history of smoking. Lipid levels, with higher mean high-density lipoprotein (HDL) and lower mean low-density lipoprotein (LDL) in the testosterone deficiency group, align with observations from Al Hayek et al.'s¹⁵ study on dyslipidemia. Certain studies highlight significant associations between low testosterone and lipid abnormalities, contributing to the complexity of the clinical scenario. Examining LH and FH levels, our study found higher LH levels in the low-testosterone group compared to the normal-testosterone group. Secondary

hypogonadism, marked by inadequate release of growth hormone (GnRH) and characterized by low secretion of LH, FSH, and SHBG, was evident, and these hormone levels decreased with age. FSH and LH decrease in the low testosterone group underscore the intricate hormonal interactions associated with T2DM. Sex hormone-binding globulin (SHBG) emerged as another crucial factor in our study, with lower mean SHBG levels (34.37 ± 12.7) in the low-testosterone group compared to the normal-testosterone group. Metabolic syndrome, obesity, and insulin resistance were implicated in lower SHBG levels. This connection further underscores the role of these factors in contributing to the complexities of hormonal dysregulation in the context of diabetes. Examining testosterone levels, our study found a mean serum testosterone level of 189 ± 120.2 in the low-testosterone group, statistically lower than that of the normal-testosterone group. The intricate relationships between testosterone, insulin resistance, and hyperglycemia were substantiated, emphasizing the inverse relationship between testosterone and T2DM. Low serum testosterone emerged as a potential threat in individuals with T2DM and metabolic syndrome, with androgen receptor polymorphism, glucose transport issues, and decreased antioxidant effects being contributing factors. In conclusion, the interplay between diabetes mellitus, testosterone levels, and associated risk factors is intricate and multifaceted. As the global prevalence of diabetes continues to rise, understanding these relationships becomes imperative for comprehensive patient care and effective disease management. The intricate web of factors influencing hormonal dynamics underscores the importance of a holistic approach to address the health challenges posed by diabetes mellitus, particularly in the realm of reproductive health and cardiovascular risks.¹⁷

LIMITATIONS

As our study is cross-sectional, we are unable to establish the chronological sequence of events, determining whether diabetes precedes the decline in serum testosterone levels or vice versa. Risk factors were evaluated within the confines of a single center, limiting the breadth of our assessment. Relying on a single low testosterone level is insufficient for diagnosing hypogonadism.

CONCLUSION

Alterations in endogenous testosterone and its binding protein SHBG are influenced by T2DM, offering clinical insights and control strategies. Assessing testosterone and SHBG is crucial for predicting risk information and identifying potential therapeutic implications. Addressing hypogonadism not only enhances glucose control but also positively impacts sexual health. Evaluating these hormonal dynamics is essential for a comprehensive understanding of diabetes-related complications and effective management strategies, emphasizing the interconnectedness of hormonal balance, diabetes, and overall health outcomes.

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Knowledge, Attitude, and Practice regarding COVID-19 and Its Vaccine in Rural Field Practice Area

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ABSTRACT

Background: The coronavirus disease 2019 (COVID-19) pandemic has affected more than 200 countries, causing loss of life and livelihood. The knowledge, attitude, and practice (KAP) of the community will influence the dynamics of pandemic behavior. There is a necessity to understand the public's awareness of COVID-19 at this critical moment to facilitate the outbreak management of COVID-19 in field practice areas. The acceptability of the newly launched vaccine is yet another parameter to be considered, since the vaccine coverage rate among the population is essential for a successful immunization program. The acceptance of the COVID-19 vaccine depends on various sociodemographic characteristics, as well as the beliefs and barriers that may prove to be hurdles during the immunization program.

Materials and methods: The present study was a cross-sectional study; the data were collected in the rural field practice area of the tertiary care hospital. The questionnaires related to demographic details and information related to KAP of COVID-19 infection and vaccine were collected in Google Forms by the interview technique.

Results: In our study, 94% of them were aware of and had heard of COVID-19 infection from the media, friends, and healthcare workers. 80% of them have heard about the COVID-19 vaccine from friends and family (99%), healthcare workers and the media (77%).

Conclusion: The findings of the present study conclude that overall, people are aware of COVID-19 infection with regard to its symptoms, route of transmission, and preventive methods. Similarly, the vaccine and its side effects in rural areas.

Keywords: Attitude, COVID-19 vaccine, COVID-19, Knowledge, Practice.

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INTRODUCTION

Coronavirus disease (COVID-19) pandemic has affected more than 200 countries, causing loss of life and livelihood.¹ In the beginning, the number of cases was less because of the strict implementation of lockdown by the Government of India.

The low literacy level establishes India as a fertile ground for COVID-19 propagation.² India's response to the COVID-19 pandemic is one of the most stringent in the world, and it scored a perfect 100 on the "Oxford COVID-19 Government Response Tracker (OxCGRT)" which compares various governments' responses to the coronavirus outbreak worldwide.³

The knowledge, attitude, and practice (KAP) of the community will influence the dynamics of pandemic behavior. There is a necessity to understand the public's awareness of COVID-19 at this critical moment to facilitate the outbreak management of COVID-19 in field practice areas.

The acceptability of the newly launched vaccine is yet another parameter to be considered, since the vaccine coverage rate among the population is essential for a successful immunization program. The acceptance of the COVID-19 vaccine depends on various sociodemographic characteristics, as well as the beliefs and barriers that may prove to be hurdles during the immunization program.

The COVID-19 pandemic has reshaped global health paradigms, highlighting the critical interplay between knowledge, attitudes, and practices in mitigating the virus's spread. Understanding how individuals perceive and respond to health information is vital in shaping effective public health strategies. Knowledge about COVID-19 transmission, symptoms, and preventive measures directly influences people's attitudes toward the disease and their willingness to adopt protective

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behaviors. Vaccination has emerged as a key tool in combating the pandemic, yet its uptake is significantly influenced by individuals' understanding of vaccine safety and efficacy. This relationship underscores the importance of fostering informed communities through targeted education and outreach, ultimately enhancing public compliance with health recommendations and improving overall community health outcomes.

Current statistics indicate that while a substantial percentage of populations in many regions have received primary vaccination series, booster shot rates remain inconsistent, particularly in vulnerable communities.

The availability of a safe and effective vaccine for COVID-19 is well-recognized as an additional tool to contribute to the control of the pandemic.^{3,4} Therefore, the present study was undertaken to study the KAP regarding COVID-19 infection and its vaccine in the rural field practice area of a tertiary care hospital.

MATERIALS AND METHODS

The present study was a cross-sectional study. After obtaining institutional ethical clearance from the ethical committee, the study's purpose was explained to the participants prior to administering the questionnaire, and informed consent was obtained. The data were collected using a prevalidated semistructured questionnaire in the rural field practice area of the tertiary care hospital of Shri BM Patil Medical College and Research Center, Vijayapura, in the months of June and July 2021. The questionnaires related to demographic details and information related to KAP of COVID-19 infection and its vaccine were collected in a Google Forms by the interview technique. Areas were selected by lottery method using simple random sampling; a house-to-house survey was done to get the desired sample size.

Sampling Method

With an anticipated proportion of knowledge regarding mask-wearing in COVID, 73%,⁵ the study would require a sample size of 480 population with a 95% level of confidence and 4% absolute precision.

The formula used $n = Z^2 \times P \times Q/d^2$

Statistical analysis was done using SPSS version 20. Descriptive statistics were used to present the participants' demographics, and the chi-square test was used to assess the association among the participants' demographics based on KAP.

The inclusion criteria: subjects above the age of 45 years and voluntary participation.

RESULTS

A total of 500 respondents have participated in our study, among them 56% of them were males and 44% were females. The majority of them belong to the age group of 45–54 years, followed by 55–64 years. 70% of them belong to the Hindu religion, and 10% are from tribal areas. 94% of them were married, and more than 50% were illiterate and daily wage workers respectively (Fig. 1).

In our study, 94% of them were aware and had heard of COVID-19 infection from the media, friends, and healthcare workers. More than 70% of them were aware of the symptoms of COVID, such as sore throat, cough, cold, fever, myalgia, breathlessness, and diarrhea. Multiple answers were given by them. A few of them have mentioned the loss of smell and taste.

More than 50% of them have knowledge regarding the transmission of disease; multiple answers were given by the participants, such as aerosol route, infected person, fomites, and mother to child. For protective measures, all of them have knowledge of using masks, maintaining social distance, and hand washing.

The present study shows that only 42% of them were aware of the knowledge of quarantine, such as who requires quarantine. Multiple answers were given by the respondents, such as international and domestic travelers, COVID patients, and those with mild symptoms. Exposed to COVID-19 infection. 33% of them have told the period of quarantine is 14 days, followed by 21 days (5%) and 7 days (4%) (Table 1).

Among the total respondents, 19% of them were tested for COVID-19, and they were diagnosed with by RT-PCR (75%), CT scan (12%), and others by multiple methods. Only 47% of them were diagnosed with COVID-19; among the diagnosed, 75% of them were admitted to the hospital and 25% of them were in home isolation (Table 2).

In our study, 80% of them have heard about the COVID vaccine from friends and family (99%), healthcare workers and the media (77%). 68% of them are also aware of the dose of the vaccine. Among

Table 1: Participants' knowledge regarding COVID-19 infection

Components		
Heard about COVID-19		
Yes	472	94.4
No	28	5.6
If yes, source of information*	49	9.8
Friends/family	55	11.0
Healthcare worker	40	8.0
Healthcare worker, friends/family	104	20.8
Media	40	8.0
Media, friends/family	75	15.0
Media, healthcare worker	109	21.8
Media, healthcare worker, friends/family		
Knowledge about symptoms		
Yes	364	72.8
No	136	27.2
List of symptoms*		
Fever	48	9.6
Fever, dry cough	86	17.2
Fever, dry cough, tiredness/ weakness	31	6.2
Fever, dry cough, sore throat	18	3.6
Fever, dry cough, tiredness/ weakness, sore throat	29	5.8
Fever, dry cough, tiredness/ weakness, sore throat, loss of smell and taste	8	1.6
Transmission of disease		
Yes	274	56.4
No	226	43.6
Route of transmission*		
Transmission via aerosols	125	25.0
Transmission via aerosols, fomites	45	16.4
Objects used by an infected person	70	5.0
Preventive method		
Wearing a face mask	160	32.0
Wearing a face mask, maintaining social distance	295	59.0
Avoid touching face/mouth/eyes/nose	5	1.0
Maintaining social distance	11	2.2
Proper hand washing	20	4.0
Heard about quarantine		
Yes	211	42.2
Do not know	289	57.8
Who requires quarantine*		
Exposed to COVID-19 patients	75	15.0
International travelers, domestic travelers, people with mild symptoms	23	4.6
Period of quarantine*		
14 days	166	33.2
21 days	23	4.6
7 days	25	5.0
Do not know	286	57.2
Total	500	

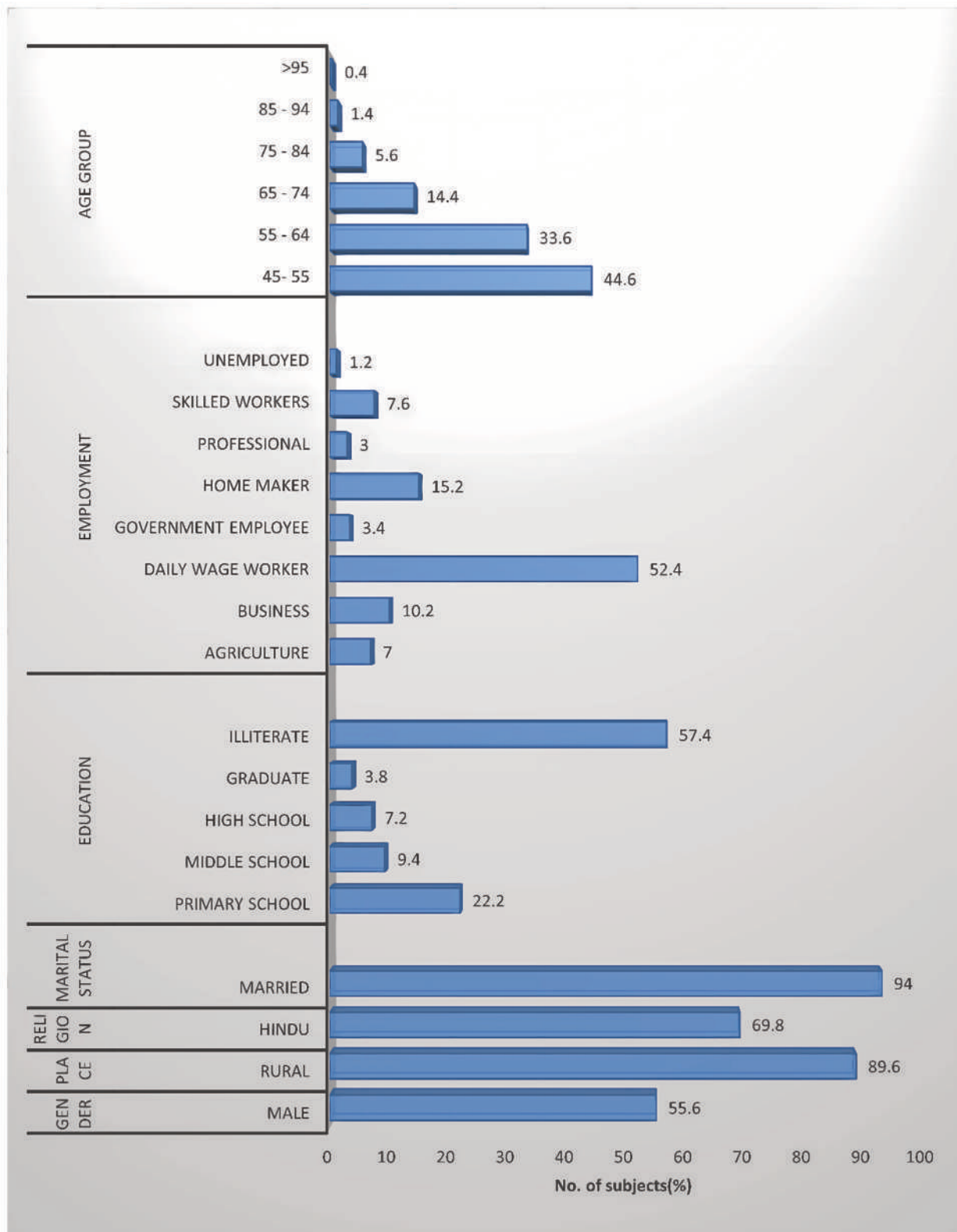


Fig. 1: Sociodemographic profile of respondents

them, 64% of them said two doses are required, and only 4% said only one dose. More than 50% of them have knowledge regarding the gap between the two doses. The majority said it is 84 days (23%), followed by 12 weeks. (16%) and others said it was 8 weeks and 4 weeks (6% and 8%), respectively.

Fifty percent of them were aware of vaccine side effects. Multiple answers were given by the respondents, such as fever, body ache, and swelling at the injection site. More than 60% of them said the vaccine is safe and essential. They told that the vaccine will reduce the spread of the disease and protect

Table 2: Participant attitude and practice toward COVID-19 infection

Components	Number	Percentage
Suffered from any of the COVID-19 symptoms		
Yes	86	17.2
No	414	82.8
Tested for COVID-19		
Yes	95	19
No	405	81.0
If yes, method of diagnosis (<i>n</i> = 94)		
RT-PCR	71	75
CT scan	11	12
RT-PCR, CT-scan	12	13
Diagnosed as COVID-19 positive		
Yes	44	47
No	50	53
If yes, admitted in (<i>n</i> = 44)		
Hospital care	33	75
Home care	11	25

them against the COVID disease. Only a few of them said the government is giving it free of cost, so they have taken it (Table 3).

With regards to knowledge regarding vaccines for COVID-19 infected patients, 50% of them responded told they do not have any knowledge related to the administration of vaccines to COVID-19-infected patients. Only 37% said it can be given to COVID-19-infected patients after the post-COVID-19 period of 12–16 weeks. Regarding reducing the spread of COVID-19 infection without vaccination, their response was only 23%. Similarly, 60% of them do not know the protection of vaccines (Table 4).

In the present study, more than 50% of them were not aware of different types of vaccine availability and whether the first- and second-dose vaccines should be the same or different types of vaccines. Among the respondents, 60% of them have received the vaccine. 42% of them have taken Covishield, and the remaining 4% of them took Covaxin, and 14% of them do not know which vaccine they have taken. Only 2% of them have paid the fee in a private hospital. 46% of them received the first dose of the vaccine, and 54% of them have received two doses. Among the vaccinated, 66% of them have one or the other side effect after taking the first dose of the vaccine. The majority of them had a fever, myalgia, and pain at the site of injection. Only 34% of them had side effects after the second dose. 29% of them experienced the same side effects for both doses, and 5% said it was different for both doses.

We observed among the vaccinated respondents, 8% of them got infected with COVID-19 after taking a vaccine, 78% after the first dose, and 22% after the second dose; the exact duration after the vaccine is not aware of it. To prevent COVID-19, the majority of them practiced one or the other method of home remedies, such as drinking warm water and salt gargling. Steam inhalation, and Ayurveda drink (kadha) (Table 5).

DISCUSSION

Understanding the knowledge, attitude, and practice of COVID-19 infection among people is a very important component to prevent

Table 3: Participants' knowledge regarding the COVID-19 vaccine

Heard about the COVID-19 vaccine	Number	Percentage
Yes	389	79.6
No	111	20.4
If yes, source of information*		
Anganwadi	10	0.2
Friends/family	32	6.4
Healthcare worker	77	15.4
Healthcare worker, friends/family	29	5.8
Media	78	15.6
Media, friends/family	21	4.2
Media, healthcare worker	56	11.2
Media, healthcare worker, friends/family	95	19.0
Aware of the dose of the vaccine		
Yes	340	68.0
No	160	32.0
If yes, how many doses		
One	18	3.6
Two	322	64.4
The gap between the two vaccines		
Yes	269	53.8
No	231	46.2
If yes, the gap between doses		
12 weeks	81	30
4 weeks	33	12
8 weeks	38	14
84 days	117	44
Aware of side effects		
Yes	256	52.8
No	244	47.2
If yes (multiple options)*		
Fever	53	10.6
Fever, body ache	74	14.8
Fever, body ache, swelling at the injection site	73	14.6
Body ache	22	4.4
Someone take vaccine, if they had COVID-19		
Yes	185	37.0
No	33	6.6
Do not know	282	56.4
If yes, when (<i>n</i> = 185)		
After 2 months (8–10 weeks)	17	9
After 3 months (12–16 weeks)	75	41
After 84 days	19	10
Do not know	74	40
Can you take the second dose of the vaccine with a different vaccine than the first dose?		
Yes	55	11.0
No	153	30.6
Do not know	292	58.4

disease, and the acceptance of vaccines was also a challenging issue when the Government of India implemented a free supply of vaccines throughout the country.

Table 4: Participants' attitudes toward the COVID-19 vaccine

Is the COVID-19 vaccine safe?		
Yes	308	61.6
No	192	38.4
Is the COVID-19 vaccine essential?		
Yes	341	68.2
No	159	31.8
Will you take the COVID-19 vaccine if it is available?		
Yes	406	81.2
No	94	18.8
Why do we have to take the vaccine*		
Protection against disease	87	17.4
The government is giving free	42	8.4
Reduce the severity	20	4.0
Reduce the spread	70	14.0
Develop immunity	6	1.2
Reduce the spread, reduce the severity	27	5.4
Reduce the spread, reduce the severity, protection against disease	22	4.4
Reduce the spread, reduce the severity, protect against disease, and develop immunity	27	5.4
Is it possible to reduce COVID-19 without vaccination?		
Yes	116	23.2
No	110	22.0
Do not know	274	54.8
Vaccines provide long-term protection		
Yes	164	32.8
No	33	6.6
Do not know	303	60.6
Follow protective measures after taking vaccinations		
Yes	385	77.0
No	115	23.0
COVID-19 infection can be eradicated without vaccination		
Yes	157	31.4
No	106	21.2
Do not know	237	47.4
The vaccine should be administered free of charge		
Yes	443	88.6
No	57	11.4

The present study observed that 94% of them had knowledge about COVID-19 infection, a similar study conducted by Kartheek et al.⁶ found a response rate was 74% for respondents' knowledge regarding COVID-19, which is lesser than our study. This could be due to differences in the age group of the study population. The majority of the Indian population demonstrated good knowledge, positive attitude, and good practice regarding the COVID-19 pandemic.⁷

Singh et al. found a notable difference in educational variables related to causes/symptoms, transmission, prevention, treatment/

Table 5: Participants' response toward vaccine practice

<i>Components</i>		
Have you taken the COVID-19 vaccine?		
Yes	299	59.8
No	201	40.2
If no, reasons* (n = 201)		
Fear of side effects	129	64.1
Nonavailability	59	29.3
Long queue (waiting period)	13	6.4
If yes, how many doses of vaccine (n = 299)		
One	137	46
Two	162	54
Any side effects after taking the first dose (n = 137)		
Yes	91	66
No	46	34
If, yes* (n = 91)		
Fever	46	51
Fever, myalgia	39	43
Fever, myalgia, swelling at the injection site, and pain at the site	16	17
Sleep disturbance	5	5
Myalgia	13	14
Side effects after taking the second dose (n = 162)		
Yes	55	34
No	107	64
If yes* (n = 55)		
Fever	19	34
Fever, myalgia	20	36
Fever, myalgia, swelling at injection sites, pain at the site of injection	10	18
Pain at the site of injection	5	9
Sleep disturbance	2	3.7
Swelling at injection sites	3	5.4
Same side effects after both doses (n = 162)		
Same	47	29
Different	8	5
Where did you take the vaccine (n = 299)		
Government	293	61.0
Private	6	1.2
Type of vaccine (n = 299)		
Covaxin	29	5.8
Covishield	210	42.4
Do not know	60	14.0
Follow protective measures after taking the COVID-19 vaccination		
Yes	294	58.8
No	5	
Infected with COVID-19 infection after vaccination (n = 299)		
Yes	23	08
No	276	92
If yes (n = 23)		
After the first dose	18	78
After the second dose	5	22
How many weeks after the first dose did you get infected (n = 18)		
1–3 weeks	10	55
4–6 weeks	5	28
7–9 weeks	3	17
Infected after the second dose (n = 5)		
1–3 weeks	2	40
4–6 weeks	2	40
7–9 weeks	1	20

care-seeking, specific knowledge, and overall knowledge scores. Additionally, significant differences were observed in prevention across gender and occupation categories.⁸

Our study found that 50% of them have knowledge regarding the transmission of disease. Christy et al.⁹ in their multicentric study found the overall KAP regarding COVID-19 disease was robust (above 80% in all categories) among the participants. This difference could be due to the low literacy level of our study participants.

In another study, Kartheek et al.⁶ observed that respondents had an accuracy for knowledge of around 75% and less than 50% of respondents had an 80% knowledge score. This shows that people were aware of COVID-19 disease with different levels of knowledge might be due to different setup of study areas.

We found good knowledge related to protective measures; all of them had knowledge regarding using masks, maintaining social distance, and hand washing. Christy et al.⁹ in their study observed that the majority (87.2%) of the participants were confident that COVID-19 can be controlled by adequate preventive measures. Several findings regarding the relationships among KAP offer important insights into how public health initiatives can enhance population health during emergencies, such as pandemics caused by emerging infectious diseases, by implementing targeted behavioral interventions.¹⁰ This shows that people might have gained awareness and knowledge about the disease and its transmission, via television, news, and media platforms, to protect themselves and their families.

More than 70% of them were also aware of the symptoms of COVID-19 infection, such as sore throat, cough, cold, fever, myalgia, breathlessness, and diarrhea. Multiple answers were given by them. Al-Hanawi et al.¹¹ found that the majority of the participants (98%) were aware of the clinical symptoms. Participants were aware of clinical symptoms, transmission, prevention, and control of the disease. This reflects that in rural communities, the people are also aware of the COVID-19-related symptoms.

In the present study, 80% of the study population is aware of the COVID-19 vaccine; other studies also observed an 80% of acceptance rate for the vaccine Bhartiya et al.¹² and Khan et al.¹³ 85% of the 351 subjects were planning to get the COVID-19 vaccine once it is available for use in the market. We collected our data when the vaccine was implemented, but in another study, it was not implemented. Similarly, a study in Bangladesh¹⁴ found more positive attitudes toward the COVID-19 vaccine among the general population. This shows that people are aware and ready to take vaccines, and in the future, all of them might take vaccines.

Currently, the main vaccines available in India are the Oxford-AstraZeneca vaccine locally referred to as Covishield, Bharat Biotech-ICMR indigenous vaccine named Covaxin and the Russian Sputnik V vaccine, which is imported.¹⁵ According to the Centers for Disease Control and Prevention (CDC), a trusted source, and the World Health Organization (WHO),¹⁶ common side effects of a COVID-19 vaccine include fever, fatigue, headache, body aches, chills, nausea, pain at the site, and diarrhea. In our study, 60% of them had received a vaccine, and among them, 66% of them had one or the other side effects after taking the vaccine's first dose. 34% of them had side effects after the second dose. The majority of vaccinated subjects had fever, myalgia, and pain at the site of injection, as per the ICMR and WHO source, which are minor and preventable.

CONCLUSION AND RECOMMENDATIONS

The findings of the present study conclude that overall, rural community people are aware of COVID-19 infection with regard to its

symptoms, route of transmission, and preventive methods. Similarly, about the COVID-19 vaccine and its side effects in rural areas. But they do not have knowledge regarding when to take a vaccine if someone is suffering from COVID-19 infection. They are also not aware of the name of the vaccine that they have received or the gap between the two doses. Therefore, we recommend that the health authorities sensitize the community regarding the gap between the two vaccines and when to take the vaccine if someone gets infected with COVID-19, and the type of vaccine available by the Government of India.

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Immunohistochemical Detection of Tissue-resident Endothelial Progenitor Cells in Astrocytic Glioma

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ABSTRACT

The study aimed to investigate the tumor endothelial progenitor cells (EPCs) of astrocytic glioma patients. A total of 22 astrocytic glioma patients were consented from Hospital Universiti Sains Malaysia. Tumors ($n = 22$) were stained with vascular endothelial growth factor receptor 2-positive (VEGFR2+) (green), CD133+ (red), and 4',6'-diamidino-2-phenylindole (DAPI) (blue), and counterstaining was performed with DAPI. The slides were washed and mounted in DPX mounting medium and then assessed using BX41 Leica microscopy at 200× magnification. In order to determine the colocalization of the two markers, pictures were taken and combined. About 13,784 mm² of the tissue area for each sample of brain tumor were investigated using ImageJ software 1.45s. A total of three patterns of EPCs tissue-resident staining were found in this study. First, the staining was found in the tissue that does not have prominent blood vessels. Second, the staining was noticed at the apical luminal of tumor tissue. Third, the staining of EPCs was also found at the blood vessels in this study. Therefore, EPCs are mainly distributed in these three regions of astrocytic glioma.

Keywords: Astrocytic glioma, CD133+, Endothelial progenitor cells, Immunohistochemical, VEGFR2+.

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INTRODUCTION

The endothelial progenitor cells (EPCs) that are actively involved in tumor angiogenesis and vasculogenesis are mainly synthesized in the bone marrow. The recruitment of EPCs originating from bone marrow into the circulation system to the tumor site caused the immature EPCs to differentiate into mature endothelial cells (ECs).^{1–4} EPCs are abundantly present in the peripheral blood of glioblastoma multiforme (GBM) patients.⁵ Moreover, the EPCs counts were higher in GBM compared to other nervous system diseases.⁶ The ability of circulating EPCs to be transported to tumor sites can be used as a biomarker for the diagnosis and prognosis of astrocytic glioma. Furthermore, in patients with astrocytic glioma, EPCs can be utilized to track the aggressiveness and angiogenicity of the tumor.^{2,7,8}

Antiangiogenic antivascular endothelial growth factor has not been developed much, and when it has, it has been linked to a number of negative side effects, including hypertension, delayed wound healing, thrombotic events, and congestive heart failure.⁹

The creation and improvement of biomarkers to gauge angiogenesis in tumors, such as measuring EPCs, may make it easier for doctors and surgeons to determine which patients are responding to antiangiogenic therapy and which ones are failing. Thus, the goal of this work was to identify the tissue-resident EPCs in all phases of astrocytic gliomas.

METHODS

Tissue collection following surgery, each of the 22 patients with astrocytic glioma had microsurgical specimens of their brain tumors taken for tissue-resident CD133 and vascular endothelial growth factor receptor 2 (VEGFR2) studies. Following tissue biopsy, samples were processed for immunofluorescence microscopy and preserved in 10% paraformaldehyde. Microscopy with immunofluorescence for brain tumors, three sections of each brain tissue sample were cut at intervals of 6.5 and 4 mm in thickness after

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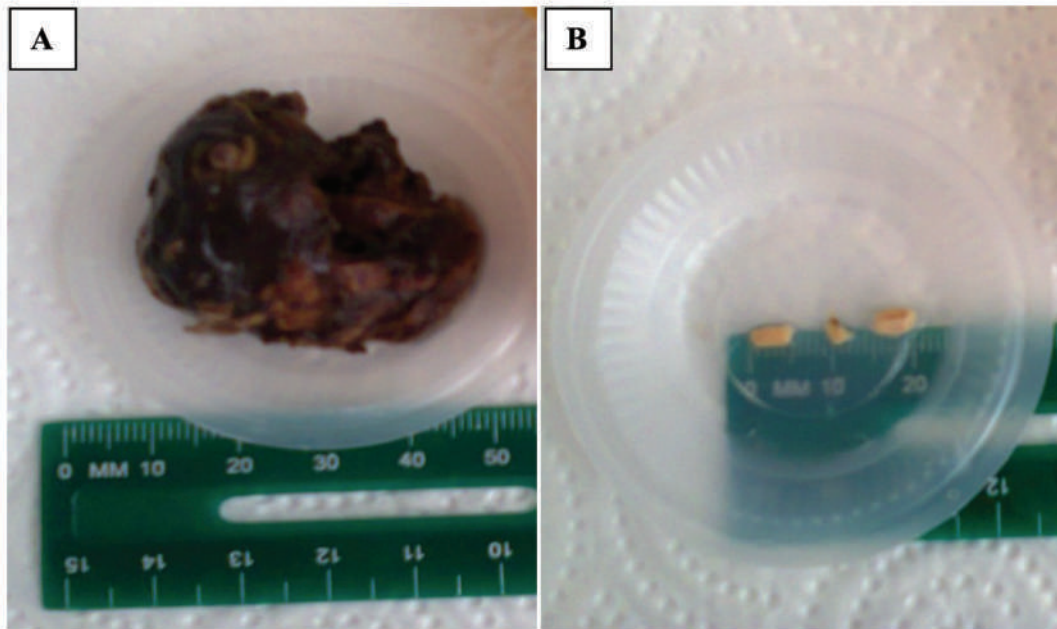
Source of support: Nil

Conflict of interest: None

the tissue biopsy samples were fixed in 10% paraformaldehyde. After being treated in a tissue processor, the tissue was embedded in a block of paraffin wax. After cutting tissue blocks to a thickness of 3 µm, eight serial dissections were performed.

The tissue was deparaffinized with two changes of xylene, rehydrated with two changes of absolute, 95 and 70% ethanol each for 3 minutes, and then rehydrated with xylene 1:1 with ethanol. After that, cold tap water was run to rinse the tissue. After adding adequate drops





Figs 1A and B: (A) Brain tumor tissue resident; (B) Normal adjacent brain tissue resident of astrocytic glioma

of 0.1% Triton X-100/PBS (phosphate-buffered saline) to the tissue, it was left for 10 minutes and then rinsed three times with PBS. Next, for 5 minutes, PBS/BSA (bovine serum albumin) 0.5% was applied to the tissue. Following an overnight incubation at 4°C in a dark, humid incubation chamber, the tissue slices were stained with phycoerythrin-conjugated antihuman CD133 and fluorescein isothiocyanate (FITC) antihuman VEGFR2 (Bioss). Following three rounds of washing with 1× PBS, the tissue was counterstained for 30 minutes using 4',6-diamidino-2-phenylindole (DAPI).

The slides were examined using BX41 Leica microscope at 200× magnification after being cleaned three times with 1× PBS and put in DPX mounting solution. The colocalization of the two markers was determined by capturing and merging the photos. For every brain tumor sample, a tissue region of around 13,784 mm² was examined. ImageJ 1.45s was used to calculate the percentages of VEGFR2 tumor cells.

Analytical Statistics

The means ± standard deviations (SDs) are used to show all data. Paired *t*-tests were applied. Pearson correlation analyses were employed. At *p* < 0.05, statistical significance was established. For 30 minutes, all analyses were conducted with SPSS software version 20.0.

RESULTS

Detection of Tissue-resident Endothelial Progenitor Cells

Each patient had a tissue sample of the brain tumor and the surrounding normal brain tissue collected for the tissue-resident EPC studies depicted in Figure 1.

Detection of tissue-resident EPCs was determined by immunofluorescence staining. The study found three patterns of EPCs staining using (CD133+/VEGFR2+) markers. The staining was found in the tissue that did not have prominent blood vessels that existed as individual cells (Fig. 2). The staining was also noticed at the apical luminal of tumor tissue (Fig. 3) and the staining of EPCs at

the blood vessels of the tumor (Fig. 4). In the immunofluorescence staining of adjacent normal brain, it was found to have less presence of EPC (Fig. 5).

For each patient, a total of 24 fields of images were taken: 24 fields for the neighboring normal brain and 24 fields for the brain tumor sample. These images were used to calculate the percentages of tissue-resident EPCs. A tissue region of around 606.50 mm² was accessible for tissue-resident EPCs. The percentages of tissue-resident EPCs in each respondent's brain tumor and surrounding normal brain, including all three kinds of staining.

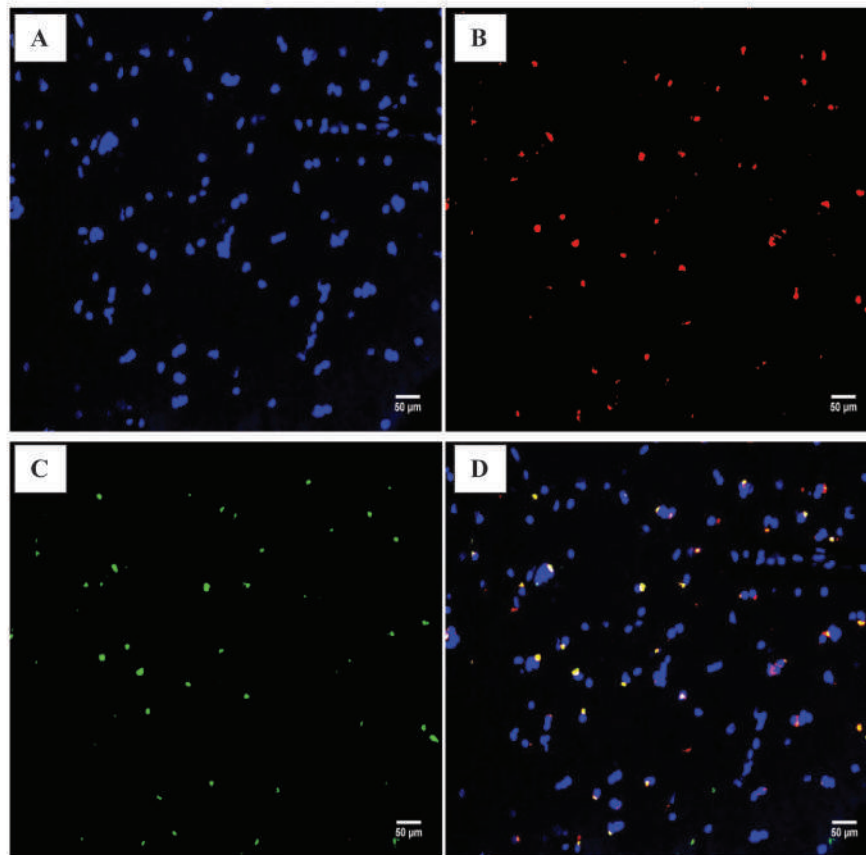
Tissue biopsy of brain tumor and adjacent normal brain tissue was obtained from each patient for the analyses of tissue-resident EPCs, as shown in Figure 1. Detection of tissue-resident EPCs was determined by immunofluorescence staining. The study found three patterns of EPCs staining using (CD133+/VEGFR2+) markers. The staining was found in the tissue that did not have prominent blood vessels that existed as individual cells (Fig. 2). The staining was also noticed at the apical luminal of tumor tissue (Fig. 3) and the staining of EPCs at the blood vessels of the tumor (Fig. 4). In the immunofluorescence staining of adjacent normal brain, it was found to have less presence of EPC (Fig. 5).

The percentages of tissue-resident EPCs were determined in a total of 24 fields of image that were captured for brain tumor sample and another 24 fields for adjacent normal brain per patient. About 606.50 mm² tissue area was accessed for tissue-resident EPCs. shows the percentages of tissue-resident EPCs which includes all three types of staining in brain tumor and adjacent normal brain in each respondent.

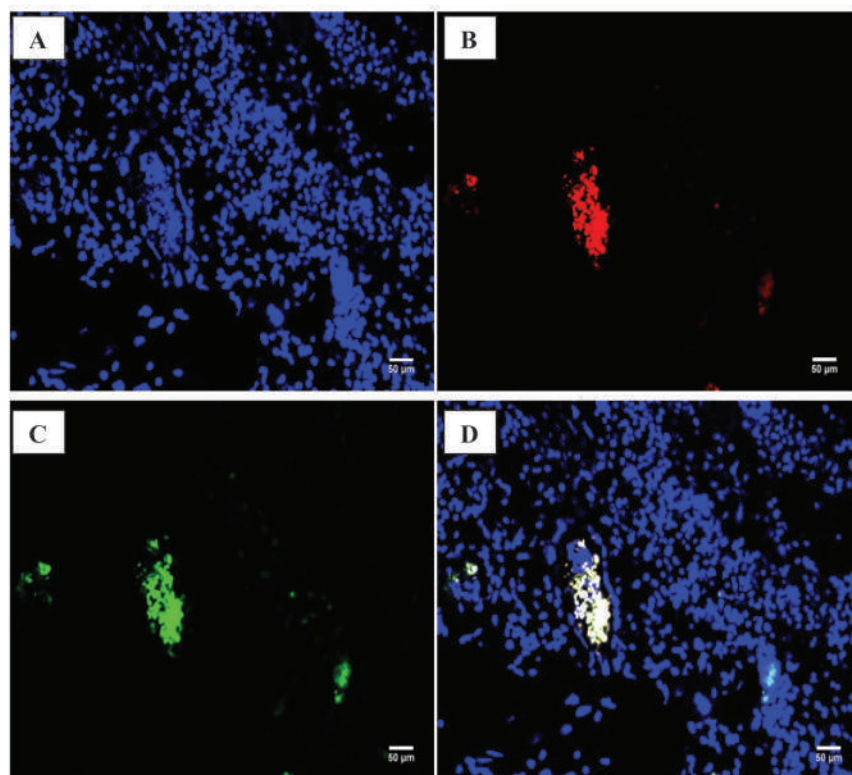
DISCUSSION

Immunohistochemical Staining Analyses of Endothelial Progenitor Cells

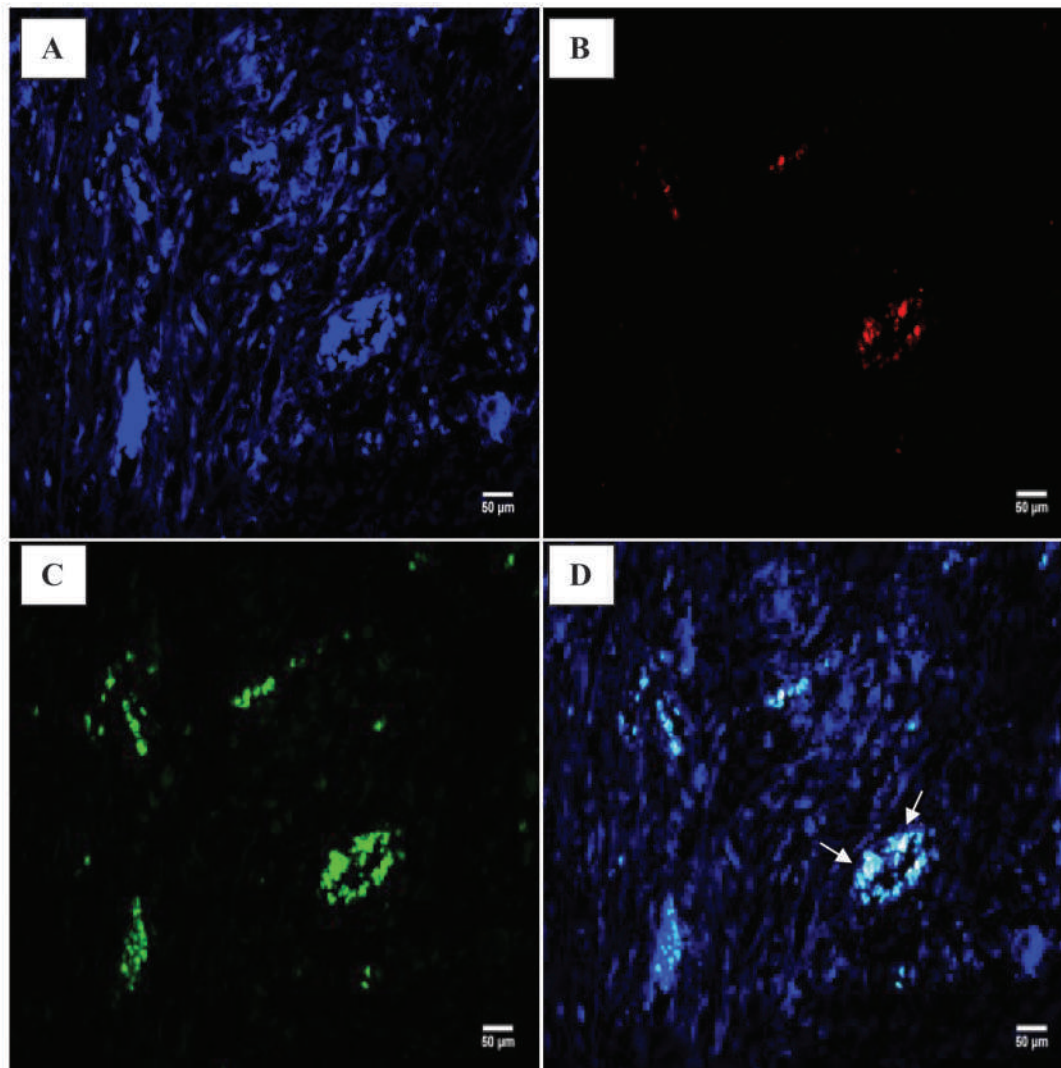
There were three patterns of EPCs staining using (CD133+/VEGFR2+) markers found in this study. The staining was found in the tissue that did not have prominent blood vessels that existed as individual cells, and



Figs 2A to D: Immunofluorescence single cell staining of tissue sections from brain tumor tissue resident (A) with nuclear counterstaining (DAPI), (B) antibody against CD133, (C) antibody against VEGFR2, and (D) merged image of (A) to (C), scale bars = 50 μm; magnification: ×200



Figs 3A to D: Immunohistochemistry of brain tumor tissue resident of astrocytic glioma (A) with nuclear counterstaining (DAPI), (B) antibody against CD133, (C) antibody against VEGFR2, and (D) merged image of (A) to (C), scale bars = 50 μm; magnification: ×200



Figs 4A to D: Immunofluorescence staining of tissue sections from brain tumor tissue resident (A) with nuclear counterstaining (DAPI), (B) antibody against CD133, (C) antibody against VEGFR2, and (D) merged image of (A) to (C), scale bars = 50 µm; magnification: ×200

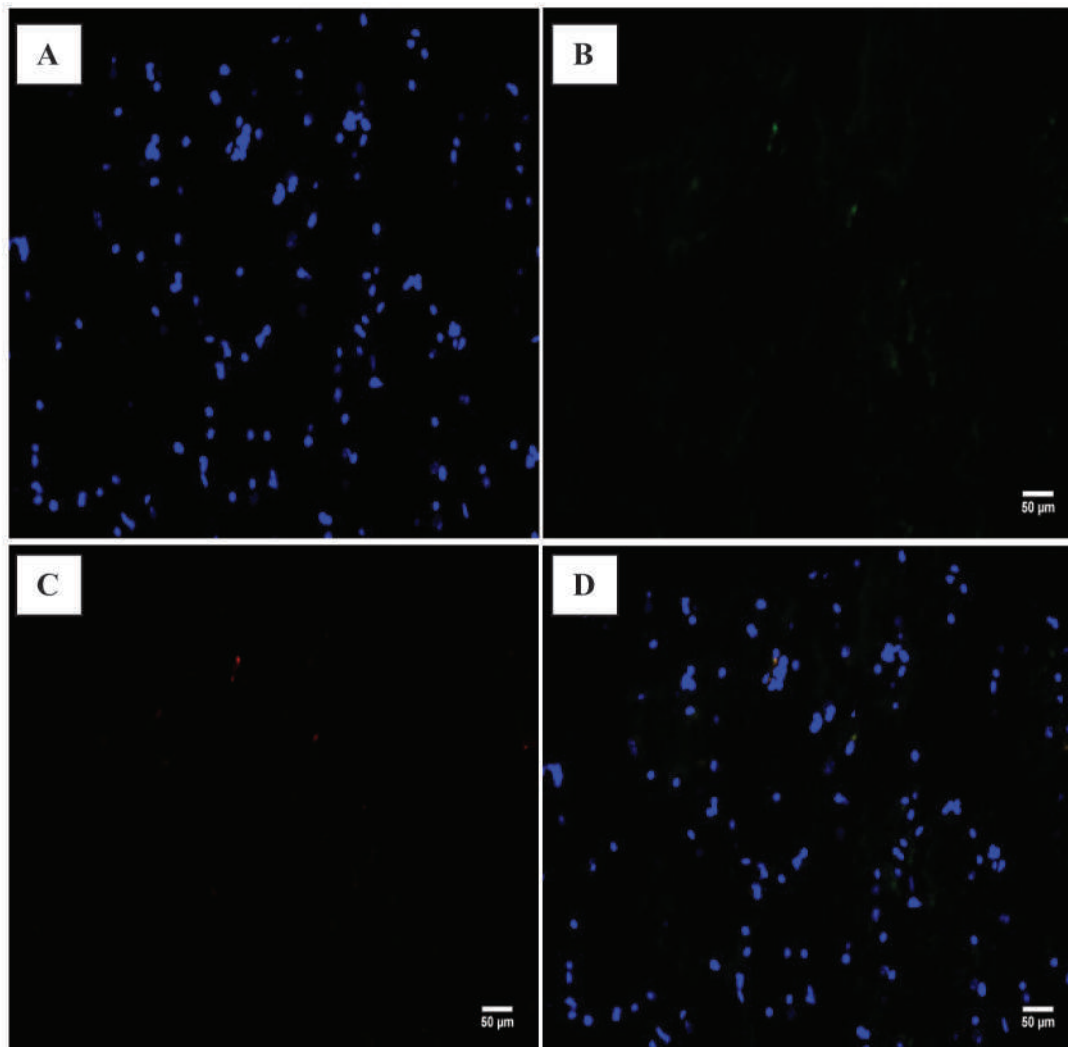
it is comparable with the study done by Yi et al.¹⁰ The staining was also noticed at the apical luminal of tumor tissue. Other previous studies among the colorectal cancer patients also pointed to the presence of CD133 staining at the apical region of the tumor cells.¹¹ The CD133+ expression was found at luminal protrusions of tumor capillary ECs that exhibit the characteristics of the activated endothelium and is found to be widespread in the brain. The immunoreactive protein expression of CD133+ in whole residual tumor of rectal cancer was seen diffusely in cytoplasm and at the apical/endoluminal surface (membranous) or cytoplasm or both of residual cancer cells.¹² Similarly, in another study, it was found that the CD133 antigen is localized on the glandular luminal surface of epithelial tumor glands with shedding into the lumina in colon cancer patients.¹³

The staining of EPCs was also found at the blood vessels in this study. The immunohistochemical staining analyses in the patients without history of rupture showed the presence of EPCs which are mainly found at the edge of the vessel walls.¹⁴ In a human glioma sample, it was found with abundant young, newly formed blood vessels. It carries characteristics of high hypertrophic endothelium with narrow lumen. The cells tend to accumulate in clusters with uncertain basal laminae and large

extravascular spaces. The zonulae occludentes exist between adjacent ECs. It also has numerous fine fibrils, endothelial-like features cells in and out of capillaries lumen were noticed, and the cells were also distributed between the layers of basement membrane. Many pinocytic vesicles and Weibel–Palade bodies in the immature ECs cytoplasm were found. The cell has larger nuclei with many indentations at the circumference. The existence of several banded structures or fibrous long-spacing collagen helps in the neoangiogenesis of glioma.¹⁵

Tumor cells that stained with CD133+ marker are mostly seen at tumor edges which are at arms of the infiltrative part and off-site of the tumor. VEGFR2 is abundantly seen in malignant glioma cells.¹⁶ Increased size, more deformed arteries, thicker walls, and greater tumor cell densities are observed in tumor endothelium that expresses the CD133+ marker, suggesting that this endothelium plays a role in fostering tumor development.¹⁷

Major mediator of the angiogenic effects of VEGF is VEGFR2, and it also has a nuclear localization. The study reports that, in ECs, nuclear VEGFR2 interacts with several nuclear proteins, including Sp1, a transcription factor that regulates the genes needed for the angiogenesis.¹⁸



Figs 5A to D: Immunofluorescence staining of tissue sections from normal adjacent brain tissue resident (A) with nuclear counterstaining (DAPI), (B) antibody against CD133, (C) antibody against VEGFR2, and (D) merged image of (A) to (C), scale bars = 50 µm; magnification: ×200

Subcellular localizations of VEGFR2+ in the EPCs cytoplasm were also seen in immunoelectron microscopy. Complex vascular structures which composed of EPCs were observed in the electron microscopy.¹⁵ Additionally, the study discovered that CD133+ and VEGF interact with ECs since neither VEGF nor CD133+ immunoprecipitated to cause the other protein to be pulled down. This finding was further corroborated by the observation of these two markers colocalizing in immunocytochemistry using confocal microscopy.¹⁹

CONCLUSION

In this study, three different patterns of EPCs tissue-resident staining were discovered. The staining was first discovered in tissue that lacked prominent blood vessels. There was staining in the apical luminal of the tumor tissue as well, and finally, the EPCs staining was discovered at blood vessels in this study. According to the findings, EPCs are primarily found in these three regions, and the detection of EPCs in this region will help in the diagnosis and prognosis of astrocytic glioma patients.

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Silent Infestation: Amebic Colitis Presenting as Bleeding per Rectum

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ABSTRACT

A 40-year-old male patient presented with a 1-year history of bleeding per rectum with hemorrhoids. He was evaluated by colonoscopy in the absence of clinical evidence of bleeding from hemorrhoids and was found to have oozing amebic ulcers without any features of dysentery in an atypical presentation of amebic colitis.

Keywords: Amebic colitis, Amoebiasis, Colonoscopy, Flexible spectral imaging color enhancement, Hematochezia

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A 40-year-old male patient presented with a 1-year history of bleeding per rectum and dyspnea on exertion, with no history of abdominal pain, mucus in stools, or analgesic use. Proctoscopy revealed small hemorrhoids with no signs of active bleeding despite multiple assessments. Blood investigations (Table 1) revealed iron deficiency anemia. Stool examination showed plenty of red blood cells (RBCs) with no evidence of ova/cysts and 8–10 pus cells.

Colonoscopy was planned to rule out colon carcinoma. Colonoscopy showed multiple large, discrete ulcers with active oozing of blood in cecum, with the intervening and rest of ileal and colonic mucosa appearing normal (Figs 1A and B). Multiple biopsies were taken for histopathological evaluation.

Histopathology revealed flask-shaped ulcers with protozoal trophozoites engulfing RBCs, suggesting amebic infestation (Fig. 2).

The patient was started on a course of oral metronidazole for 14 days and iron supplementation. A repeat stool test for occult

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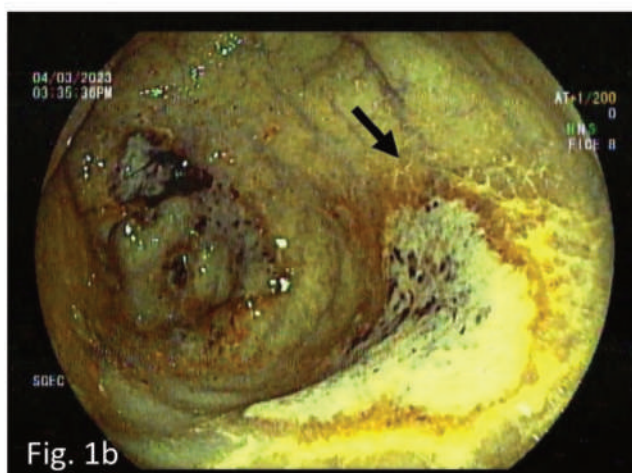
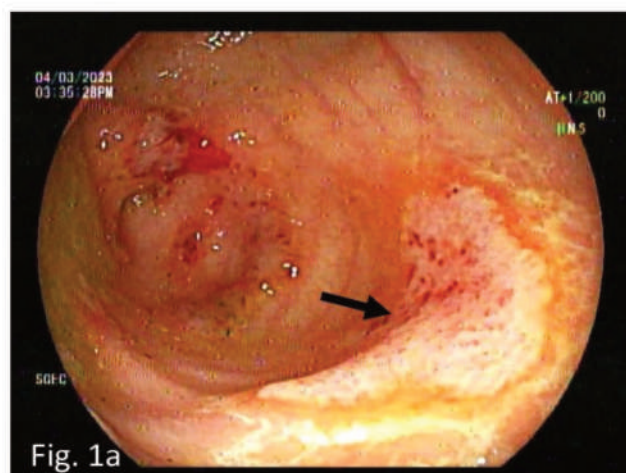
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Figs 1A and B: (A) Endoscopy and (B) flexible spectral imaging color enhancement (FICE) image of cecum showing multiple discrete ulcers (arrows) with intervening normal mucosa

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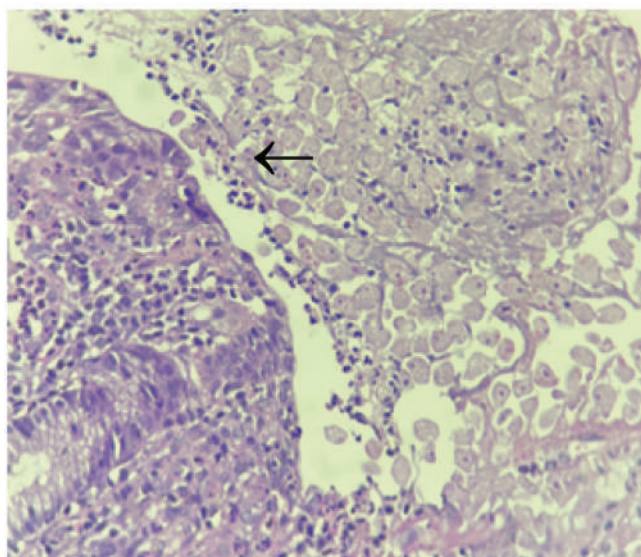


Fig. 2: Hematoxylin and eosin (H&E) 40x image of colon biopsy specimen showing trophozoites ingesting RBCs (arrow)

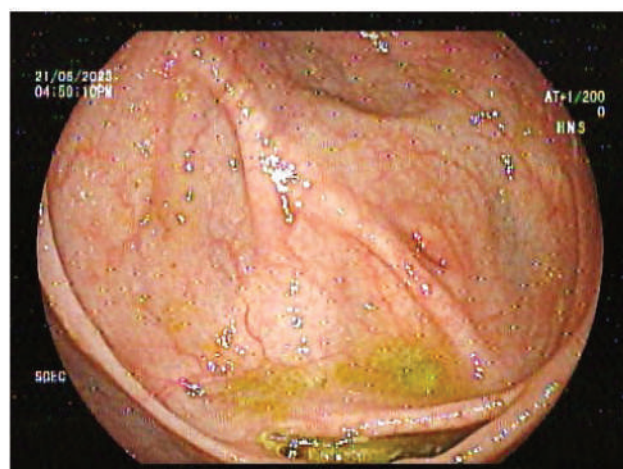
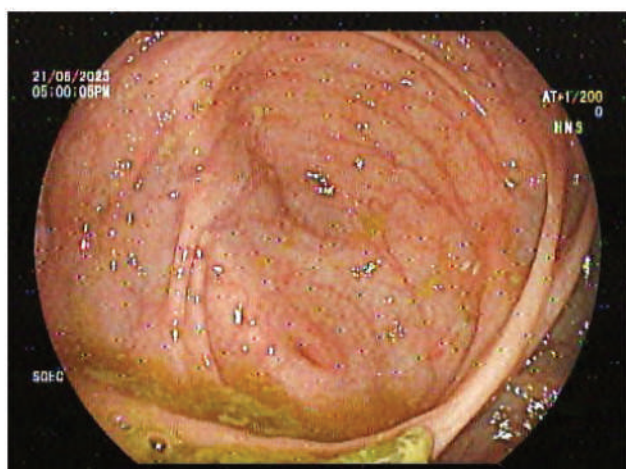


Fig. 3: Endoscopy images of cecum showing no evidence of previous ulcers

Table 1: Investigations of the patient

Investigation	Report	Investigation	Report
Hemoglobin	8.4 gm/dL	Iron	31 µg/dL
TLC DLC	4070/µL N ₆₆ L ₂₈	TIBC	470 µg/dL
Platelet count	1.96 million/µL	Iron saturation	6.6%
Urine R/M	No abnormality	Stool R/M	No abnormality

DLC, differential leukocyte count; R/M, routine and microscopy; TLC, total leukocyte count; TIBC, total iron-binding capacity

blood was negative after 1 month. Further investigations found no evidence suggestive of extraintestinal amebiasis. The ulcers were found to have completely resolved on follow-up endoscopy (Fig. 3).

The above was a rare presentation of amebic ulcers presenting as bleeding per rectum in the absence of features of colitis or invasive disease in an immunocompetent host.

The case highlights the need to consider intestinal infestation as a differential in bleeding per rectum cases without features of dysentery or colitis, especially in a high prevalence country like India,¹ and further emphasizes the need to include more sensitive noninvasive tests such as polymerase chain reaction (PCR) in the

conservative management of hematochezia before undertaking invasive tests and reducing the reliance on stool microscopy for ruling out intestinal infestations.²

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“Judges Are Humans, Make Mistakes...,” What about Doctors?

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ABSTRACT

A recent observation by the Honorable Supreme Court highlighted the issue of immense work pressure on our esteemed judges. Are doctors not under ever-increasing pressure on multiple fronts? We attempt to look into the unique challenges that we, as medical professionals, face every day and argue for a more considerate view from society.

Keywords: Doctors, Human, Work pressure.

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There was a news item published earlier this year, on January 30, 2025, in all the leading newspapers of the country, where the Honorable Supreme Court of India, while reversing a Punjab and Haryana High Court order—which resulted in three accused serving rigorous imprisonment for 3 months—called it an “egregious error” and said, “Judges are human beings and they at times commit mistakes. The sheer pressure of work at times may lead to such errors.” This statement is significant as it recognizes the vulnerabilities of judges as ordinary humans.¹

This has interesting ramifications for medical professionals. The moot question is whether the same standard and logic apply to doctors.

In order to answer this question, it is pertinent to look into the challenges faced by the custodians of the judicial system and by the pilots in the aviation industry.

THE CHALLENGES BEFORE THE JUDICIAL SYSTEM

The Indian judicial system has been at the forefront of guarding the rights and privileges of all Indian citizens enshrined in the Constitution. As of June 2024, India faces a staggering backlog of over 51 million pending court cases across all levels and types of courts. This includes more than 180,000 cases that have been unresolved for over 30 years. The country has only 21 judges per million people, a stark contrast to the Law Commission’s recommended 50.² These statistics alone underscore the first and foremost challenge before our judicial system—that of esteemed judges being under tremendous work pressure.

CHALLENGES BEFORE THE MEDICAL PROFESSION

The “healing hand” has been respected, almost venerated, throughout the annals of human history. Until recently, no law governed the doctor–patient relationship or the services rendered by health professionals. Incidents of violence directed against doctors or healthcare establishments were virtually unheard of.

However, much water has flowed under the bridge, and the dynamics of the doctor–patient relationship and healthcare management have changed in many ways. The mutual trust that

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overarched the relationship with patients has evaporated in the heat of corporatization, commercialism, ever-rising expectations, and infrastructural deficiencies in healthcare systems.

One of the manifestations of this development is the rising number of incidents of violence against doctors. This fact is borne out by a study conducted by the Indian Medical Association, which found that more than 75% of doctors across the country have faced at least some form of violence. Not surprisingly, 82.7% of them reported feeling “stressed.” The fear of violence was the main stressor reported, followed by the fear of being sued.³ It is also true that these worrying statistics reveal only a part of the reality, as many cases go unreported.

Doctors were brought into the ambit of the Consumer Protection Act in the landmark case of the Indian Medical Association vs VP Shantha in the year 1995.⁴

THE MISSING FACE OF MEDICAL HEALTHCARE SERVICES

A ringside view of an average day in a doctor’s professional life reveals the aspects of medical healthcare that were, possibly, overlooked when the Consumer Protection Act was extended to include doctors under its purview.

While managing a patient in an emergency setting, does the treating doctor have sufficient time to arrive at a definitive diagnosis? If, by any means, the decisions taken by the treating doctor go wrong, is it possible for the doctor to review and rectify those decisions?



A comparison with the working conditions of our esteemed judges is presented below:

- Patients do not come with any fixed or standard set of problems, and there are no uniform protocols. Each health issue is unique for each patient, and each patient is unique in himself or herself. So, there is always an element of uncertainty and unpredictability where clinical judgment and decisions may differ for different patients with the same or similar disease.
- Doctors are directly answerable to patients and their families. They are in direct contact with and remain under constant scrutiny and stress to manage ever-restive patients and their families. There is no layer of protective shield for doctors that exists for many categories of public servants.
- Judges' decisions are reached after thorough deliberations. They are not under pressure to give a verdict immediately. A doctor must decide in a split second about the course of action, such as during surgery or in an acute emergency, where there is a question of life and death.
- The judges' decisions can be reviewed and might even be reversed by a higher court of appeal without any fear of penal action, whereas doctors' decisions are final and cannot be reviewed or reversed.
- Stress, overwork, and burnout are real problems among doctors. Rates of suicide are two and a half times higher among doctors than in the general population.
- There is no consideration for the working environment, working hours, or the materials and manpower needed for delivering optimal healthcare.
- Medical care is teamwork in which doctors, nurses, paramedics, laboratory technicians, pharmacists, engineers, administrators, and sanitation staff have to perform in their respective areas of duty.

Agreed that judges are human beings and can commit errors, but why is the same yardstick not applied to doctors? There is an urgent need to reclaim the spirit of the "healing hand."

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