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MICROBIAL PROFILE AND SURGICAL MANAGEMENT PATTERNS IN VARIOUS WOUNDS: A RETROSPECTIVE OBSERVATIONAL STUDY IN A TERTIARY CARE CENTRE

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ABSTRACT
This study provides a comprehensive evaluation of wound characteristics, microbial profiles, and reconstructive approaches managed within a tertiary plastic surgery department in Thanjavur medical college. A retrospective observational study of 63 patients was assessed for demographic patterns, etiological factors, laboratory markers, culture findings, and operative interventions. Traumatic injuries particularly road traffic accidents emerged as the predominant cause. Lower-limb wounds constituted over half of the cases. Gram-negative pathogens, notably Pseudomonas spp. and Klebsiella spp., were frequently isolated. Split-thickness skin grafting remained the most commonly employed reconstructive method. These findings underscore the importance of targeted trauma-prevention strategies, optimized infection control, and structured reconstructive planning.

KEYWORDS: Wound, microbial profile, plastic surgery, infection, injury.

INTRODUCTION
A wound refers to any disruption or injury to the skin caused by trauma, accidents, surgical procedures, or burns, creating a potential entry point for bacterial invasion and subsequent infection. Wound infections occur when one or more microbial species successfully infiltrate and multiply within the affected area, often leading to the formation of pus.[1] The predominant bacterial pathogens responsible for wound infections include *Staphylococcus aureus* and *Pseudomonas aeruginosa*, collectively accounting for approximately 20–40% of nosocomial, post-surgical, and burn-related infections. Additionally, other opportunistic pathogens, such as *Enterococci* and *Enterobacteria*, are frequently associated with infections, particularly in immune compromised patients following abdominal surgery.[2]

Effective wound management is essential to promote healing, prevent infection, and minimize complications. This involves cleaning the wound, applying appropriate dressings, and using antibiotics when necessary.[3,4] For infected wounds, pus culture is a critical diagnostic tool to identify the causative microorganisms and guide targeted antimicrobial therapy.[5]

Surgical management plays a vital role in treating complex or non-healing wounds. Procedures such as wound debridement, which involves the removal of dead or infected tissue, help to reduce bacterial load and stimulate the healing process.[6,7] In cases where there is significant tissue loss or a need for rapid closure, techniques like split-thickness skin graft (SSG) or flap cover are employed.[8,9] These surgical interventions aim to restore the skin's integrity, protect underlying structures, and promote faster recovery.

This study aims to understanding the types of wounds and their potential for infection, alongside the available management and surgical techniques, is crucial for optimizing patient outcomes and ensuring effective healing.

METHODS

Data Collection

A retrospective observational study was conducted in the Department of Plastic and Reconstructive Surgery, Thanjavur Medical College. Medical records of 63 patients who received inpatient wound management during the study period from January 2022 to July 2022 were reviewed. Data were collected using a structured extraction form capturing demographic variables (age, sex), wound etiology, anatomical site of involvement, laboratory parameters (haemoglobin, blood glucose, urea, creatinine), microbiological findings from pus culture, and surgical procedures performed.

Wound etiologies were categorized into predefined groups such as road traffic accidents (RTA), accidental trauma, burns, diabetic foot, and others. Anatomical wound locations were classified into upper limb, lower limb, trunk, or other regions showed in Figure 1. Microbiological culture reports were analysed and organisms were grouped into clinically relevant categories including Pseudomonas spp., Staphylococcus aureus, Klebsiella spp., Proteus spp., and "No growth."

Figure 1: Various types of Wounds.

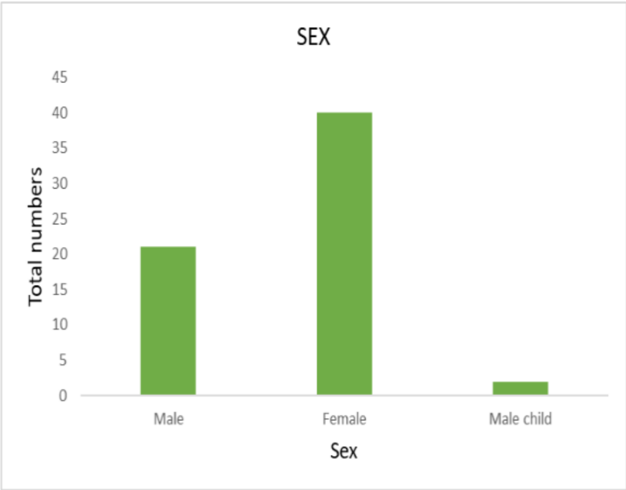
Data Analysis

Quantitative laboratory values were cleaned and converted into numerical format for analysis. All data were entered into Microsoft Excel and analyzed using descriptive statistics. Categorical variables were summarized as frequencies and percentages. Continuous variables were expressed as mean ± standard deviation. Chi-square test evaluated whether the distribution of cases across variables (Age, Sex, Etiology, Diagnosis, etc.)

RESULTS

Demographic and Clinical Profile

A total of 62 patients with acute and chronic wounds were included in the study. The mean age of the study population was 36.4 ± 19.0 years, with a range of 3–75 years. The maximum number of patients belonged to the 21–40-year age group (38.7%), followed by ≤20 years (25.8%), 41–60 years (25.8%), and >60 years (9.7%). Males constituted the majority of cases showed in Figure 2A & 2B and Table1 & 2.



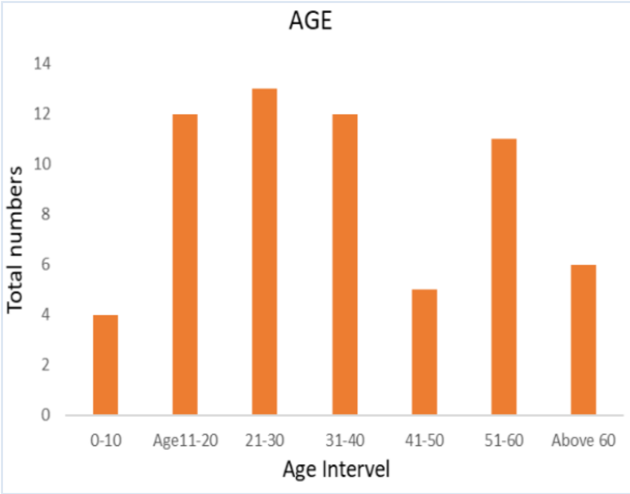


Figure 2A **Figure 2B**

Figure 2A&2B: Bar chart representing the distribution of cases by sex and Age. Male patients constituted the majority (63.5%), reflecting a significant male predominance in injury-related presentations (*p < 0.001*).

Etiology of Wounds

Trauma was the predominant cause of wounds in the study population. Road traffic accidents (RTA) accounted for 38.7% of cases, while accidental trauma unrelated to RTA (falls, blunt injuries, cut/occupational injuries) accounted for 27.4%. Burns, including thermal, electrical and cracker-related injuries, constituted 9.7% of cases. Diabetic foot/ulcer was reported in 4.8% of patients, whereas pressure sores and assault-related injuries accounted for a smaller proportion. Chronic non-diabetic ulcers were seen in isolated cases showed in Figure 3.

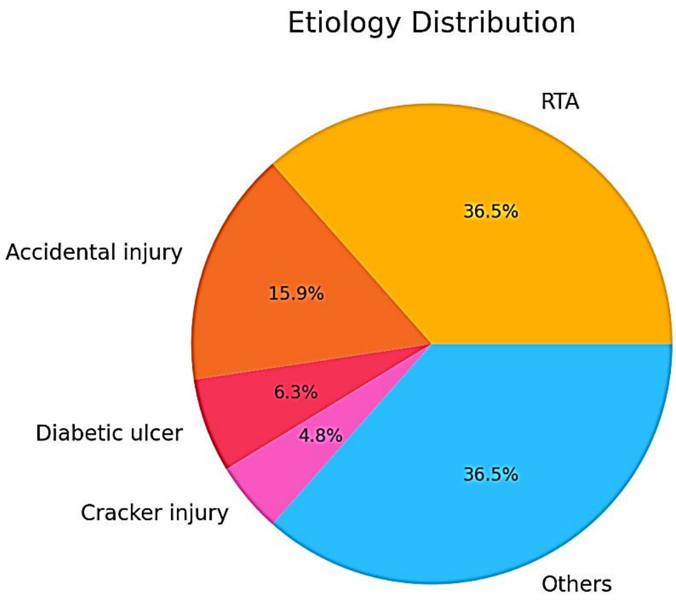


Figure 3: Pie chart indicating the etiological distribution of wound patients. Road traffic accidents (RTAs) were the leading cause (36.5%), followed by accidental injuries (15.9%) and diabetic ulcers (6.3%). The histogram reveals significant heterogeneity in etiology (p < 0.001), with trauma-related mechanisms contributing disproportionately to clinical burden.

Anatomical Distribution of Wounds

The lower limb was the most commonly affected accounting for 53.2% of all wounds, followed by the upper limb (30.6%). Wounds involving the trunk (4.8%) and other cases with insufficient documentation comprised the remaining proportion showed in Figure 4.

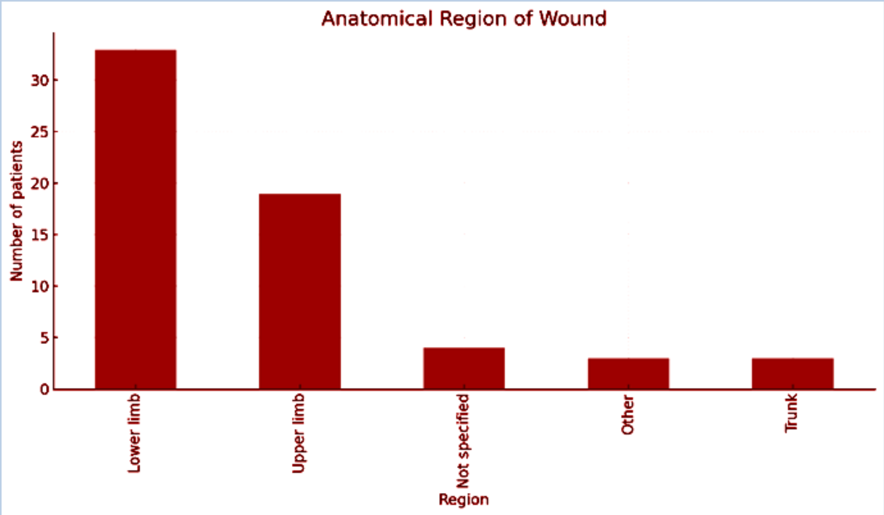


Figure 4: Bar chart denoting the Anatomical distribution of wound.

Laboratory Parameters

Laboratory investigations demonstrated mild to moderate anaemia, with meanhaemoglobin of 9.5 ± 1.6 g/dL. Blood sugar levels exhibited wide variation, with a mean of 97.4 ± 74.3 mg/dL, indicating the presence of hyperglycaemia in some patients. Renal parameters were largely within normal limits, with mean urea and creatinine values of 29.9 ± 9.3 mg/dL and 0.75 ± 0.27 mg/dL, respectively.

Pus Culture and Microbiological Profile

Pus culture reports were available for most patients. The most common finding was mixed/unspecified organisms ("Others") in 38.7% of cases. Pseudomonas spp. (12.9%), Staphylococcus aureus (9.7%), Klebsiella spp. (4.8%), and Proteus spp. (1.6%) were the predominant isolates. No growth was observed in 11.3% of samples, while culture was not performed/not recorded for 19.4% of cases showed in Figure 5.

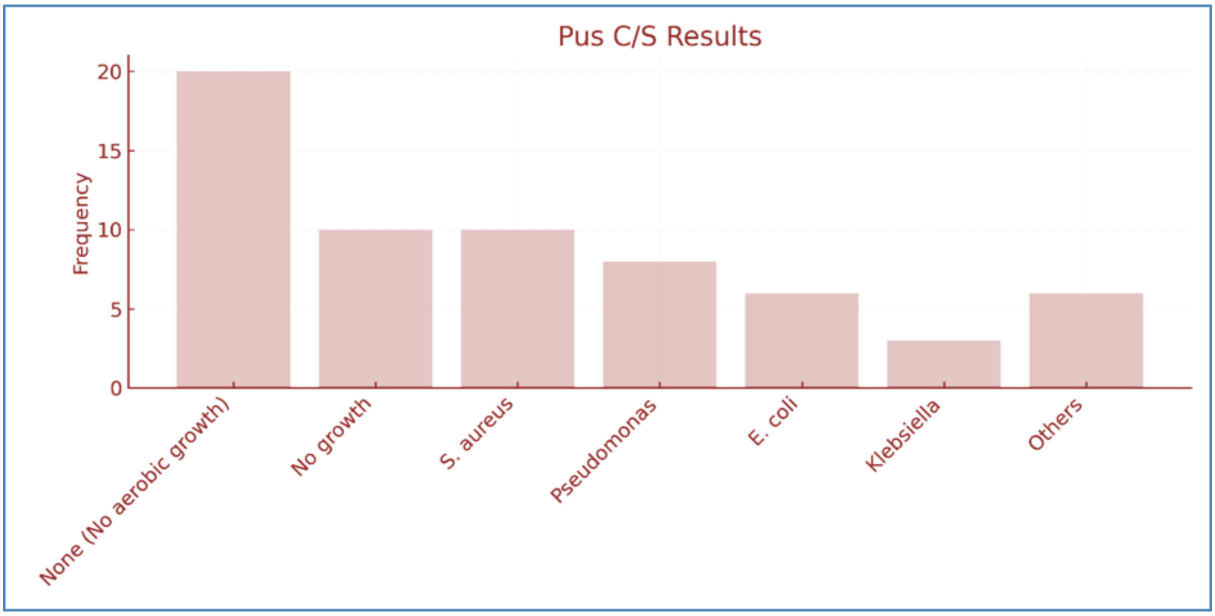


Figure 5: Frequency of microbiological isolates obtained from pus samples. "No aerobic bacterial growth" (31.7%) and "No growth" (15.9%) were the most common outcomes. Among isolates, Staphylococcus aureus, Pseudomonas spp., and Escherichia coli were predominant. The distribution deviated significantly from expected values ($p < 0.001$), indicating non-random clustering of pathogens.

Surgical Procedures

The majority of patients underwent Split-Thickness Skin Grafting (SSG), which was performed in 50% of cases. Flap + SSG reconstruction constituted 19.4%, while flap cover alone was required in 9.7% of cases. Debridement (± SSG) accounted for 8.1%, and external fixation was used in 1.6% of patients. Surgical details were undocumented in a small subset showed in Figure 6.

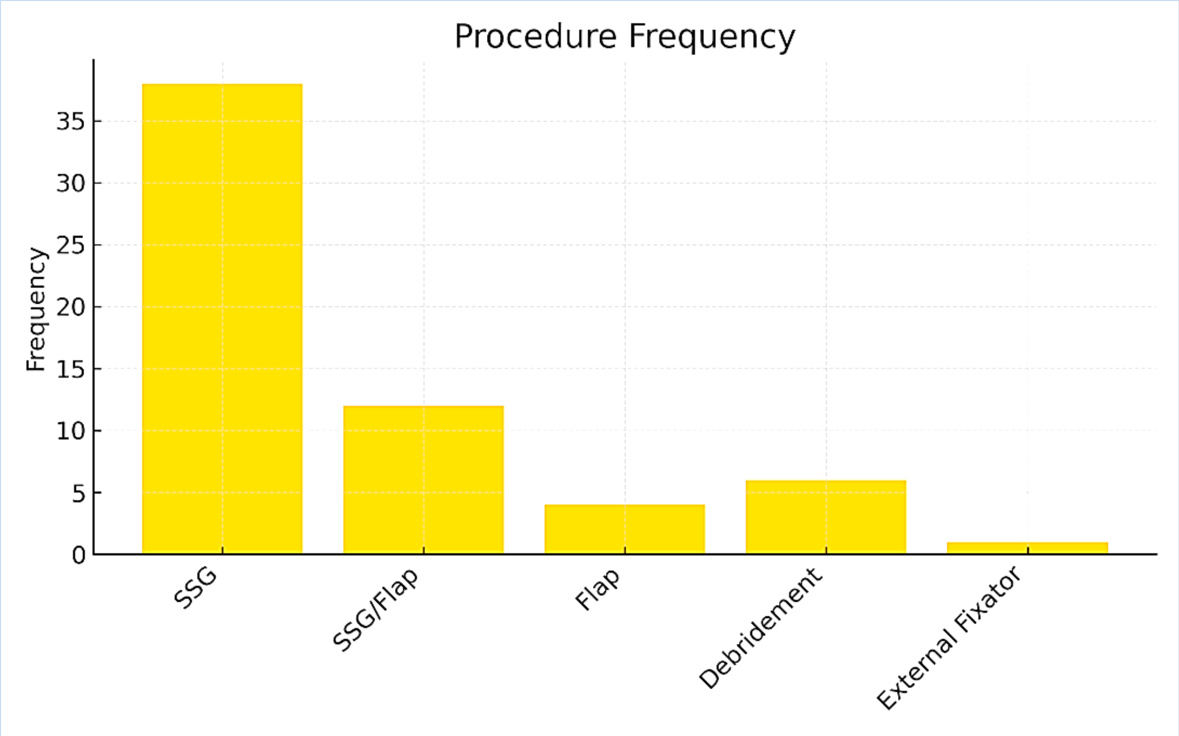


Figure 6: Bar chart showing the distribution of surgical procedures undertaken. Split-thickness skin grafting (SSG) accounted for the majority of interventions (60.3%), followed by combined SSG/flap cover procedures (19.0%). The highly skewed distribution ($p < 0.001$) indicates a procedural preference driven by clinical needs and wound characteristics.

The distribution of cases across variables (Age, Sex, Etiology, Diagnosis, etc.) deviates significantly from a uniform/expected distribution. Significant p-values (<0.05) indicate non-random clustering, implying clinical relevance showed in Table1 & 2.

Table 1: Patients wound distribution based on variables.

Variable	χ^2 value	df	p-value	Significance
Age	25.68	36	0.899	NS (no significant deviation)
Sex	34.38	2	<0.001	Significant (Male predominance)
Pus C/S Report	73.19	11	<0.001	Significant (Major variation in organisms)
Surgical Patterns	193.98	9	<0.001	Highly Significant (Split-Thickness Skin Graft (SSG) much more common)
Wound Anatomical Region	68.57	26	<0.001	Significant (Lower limb area)
Wound Etiology	197.95	23	<0.001	Highly Significant (RTA most common)

Table 2: Summary of Demographic, Microbiological, Diagnostic, Surgical, Anatomical, and Etiological Characteristics of Wound Cases (N = 63).

Category	Subcategory	Frequency (n)	Percentage (%)
Sex distribution	Male	40	63.5
	Female	21	33.3
	Male child	2	3.2
Pus culture and sensitivity	No aerobic bacterial growth	20	31.7
	No growth	10	15.9
	Staphylococcus aureus	10	15.9
	Pseudomonas spp.	8	12.7
	Escherichia coli	6	9.5
	Klebsiella spp.	3	4.8
	Others	6	9.5

Common diagnoses	Raw area right leg	9	14.3
	Raw area left hand	7	11.1
	Raw area left leg	5	7.9
	Raw area right foot	3	4.8
	Post-traumatic raw wounds	2	3.2
	Others (single-case conditions)	37	58.7
Surgical procedures	Split-thickness skin graft (SSG)	38	60.3
	SSG + Flap cover	12	19.0
	Flap cover	4	6.3
	Debridement (all types)	6	9.5
	External fixator	1	1.6
Anatomical region involved	Right leg	9	14.3
	Left hand	8	12.7
	Right foot	7	11.1
	Left leg	6	9.5
	Left foot / Right hand	5	7.9
	Others	23	36.5
Etiology	Road traffic accident (RTA)	23	36.5
	Accidental injury	10	15.9
	Diabetic ulcer	4	6.3
	Cracker burst injury	3	4.8
	Others (minor etiologies)	23	36.5

DISCUSSION

The present study provides important insights into the demographic patterns, etiological factors, laboratory abnormalities, microbial characteristics, and surgical management of wound patients treated in a tertiary care setting. The predominance of young adult males (mean age 36 years) in the current study is consistent with prior epidemiological evidence. The previous study reported that males between 20 and 40 years constitute the largest proportion of traumatic wound cases, primarily due to greater outdoor mobility and occupational exposure.[10] This finding is also supported by national road-safety surveillance reports, which indicate that young adult men remain the most vulnerable group for injury-related morbidity (Ministry of Road Transport & Highways, 2020).[11]

In this study, road traffic accidents accounted for nearly 40% of all wounds, a pattern comparable to the observations of prior research, which identified RTAs as the leading cause of soft-tissue injuries in urban and semi-urban India.[12] Lower-limb involvement was most common in our cohort, aligning with the findings of earliest research, who reported that the lower extremities are disproportionately affected in high-impact trauma due to their exposure during vehicular collisions and falls.[13]

Laboratory findings revealed mild to moderate anemia and wide variability in blood glucose levels. The role of anemia in impairing wound healing owing to reduced tissue oxygenation is well recognized.[14] Similarly, hyperglycemia has been shown to compromise leukocyte function, heighten oxidative stress, and delay tissue repair, as emphasized in diabetic wound-care literature.[15] The observations in our study are in accordance with these established physiological mechanisms.

The microbiological profile demonstrated that Gram-negative organisms, particularly Pseudomonas aeruginosa and Klebsiella spp., were prominent isolates, followed by Staphylococcus aureus. These findings parallel those of previous analysis, which identified Gram-negative bacilli as major contributors to chronic wound colonization.[16] The increasing prevalence of antibiotic-resistant Gram-negative pathogens, such as Pseudomonas and Klebsiella, seen in our study, also mirrors prior reports from tertiary care centers in India.[17] The presence of S. aureus, including potential methicillin-resistant strains, is consistent with global trends in chronic wound infections.[18]

Surgical management in this cohort was dominated by split-thickness skin grafting (SSG), followed by flap-based procedures for more complex wounds. These findings are consistent with the principles of the reconstructive ladder described by Mathes and Nahai (1997), which emphasize early debridement, wound bed preparation, and timely coverage to minimize infection and promote healing. Furthermore, previous investigations reported similar trends in lower-limb trauma reconstruction, wherein flap cover was essential for wounds with exposed bone, tendon, or orthopedic hardware.[19]

Overall, the findings of this study corroborate existing evidence in the wound-care and reconstructive surgery literature. The results underscore the importance of multidisciplinary management including trauma prevention strategies, robust infection control policies, culture-guided antimicrobial therapy, and optimal surgical planning to improve patient outcomes. Additionally, improved documentation of culture reports and perioperative risk factors could further strengthen future clinical audits and research.

CONCLUSION

The findings emphasize the necessity for improved trauma prevention strategies, rigorous infection control measures, and integrated multidisciplinary care to enhance wound-healing outcomes. Strengthening documentation and ensuring consistent microbiological surveillance will further support evidence-based clinical decision-making and quality improvement in wound management services.

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DECLARATIONS

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Conflict of interest: Nil

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REFERENCES

1. Maharjan N, Mahawal B. S. Bacteriological profile of wound infection and antibiotic susceptibility pattern of various isolates in a tertiary care center. Journal of Lumbini Medical College, 2020; 8(2): 218-224.
2. Sarwar N, Ahmad B, Azam S, Rehman N. Identification and antimicrobial susceptibility profile of bacterial pathogens isolated from wound infections in a teaching hospital, Peshawar, Pakistan. Advancements in Life Sciences, 2017; 5(1): 08-12.
3. Leaper D. J, Schultz G, Carville K, Fletcher J, Keast D, et al. Extending the TIME concept: What have we learned in the past 10 years? International Wound Journal, 2012; 9(2): 1–19.
4. World Health Organization. (2018). WHO guidelines for wound management. WHO Press.
5. Bowler P. G, Duerden B. I, Armstrong D. G. Wound microbiology and associated approaches to wound management. Clinical Microbiology Reviews, 2001; 14(2): 244–269.
6. Steed, D. L. Debridement. The American Journal of Surgery, 2004; 187(5A): 71S–74S.
7. Falanga V. Wound healing and its impairment in the diabetic foot. The Lancet, 2005; 366: 1736–1743.
8. Branski L.K, Herndon D. N, Barrow R. E, Jeschke M. G. Skin substitutes and skin grafts. Clinical Plastic Surgery, 2009; 6(4): 635–641.
9. Mathes S.J., Nahai F. Reconstructive surgery: Principles, anatomy, and technique. Churchill Livingstone, 1997.
10. Gupta N, Kumar V. Epidemiology of traumatic soft tissue injuries in India. Indian Journal of Surgery, 2018; 80(3): 234–240.
11. Ministry of Road Transport & Highways. Road accidents in India—2020: Annual report. Government of India.
12. Singh A, Kumar P, Lal P. Patterns of road traffic injuries in India: A hospital-based study. Journal of Clinical Orthopaedics and Trauma, 2017; 8(3): S41–S45.
13. Shrestha R, Singh A, Gautam R. Lower limb trauma patterns and outcomes in a tertiary care centre. Trauma Care., 2019; 6(2): 78–85.
14. Gottrup F. Oxygen in wound healing and infection. World Journal of Surgery, 2004; 28(3): 312–315.
15. Jeffcoate W.J, Harding K.G. Diabetic foot ulcers. The Lancet, 2003; 361: 1545–1551.
16. Fazli M, Bjarnsholt T, Kirketerp-Møller K, Jørgensen, et al. Nonrandom distribution of Pseudomonas aeruginosa and Staphylococcus aureus in chronic wounds. Journal of Clinical Microbiology, 2009; 47(12): 4084–4089.
17. Ghosh S, Kaushik S, Nagarajan A, Pal N. Microbiological profile of chronic wound infections. Indian Journal of Medical Microbiology, 2015; 33(3): 415–421.
18. Tong S.Y.C, Davis J.S, Eichenberger E, Holland T, Fowler V.G. Staphylococcus aureus infections: Epidemiology, pathophysiology, clinical manifestations, and management. Clinical Microbiology Reviews, 2015; 28(3): 603–661.
19. Singh M, Chauhan S, Srivastava R. Flap reconstruction in lower-limb trauma: Clinical outcomes in a tertiary centre. Indian Journal of Plastic Surgery, 2019; 52(2): 231–238.