International Journal of Medicine

journal homepage: www.ijmjournal.org

Original Research Article

Comparison of Continuous and Interrupted Fascial Closure of Midline Laparotomy Wounds

Shaik Saazid[1], Jyothula Srinivasa[2], Indukuri Kavya[2] & Savalam Bujjitha Rathna Kishore[*3]

[1]Final Year Post Graduate, Department of General Surgery, Rangaraya Medical College

[2]Assistant Professor, Department of General Surgery, Rangaraya Medical College

[3]Associate Professor, Department of General Surgery, Rangaraya Medical College

HIGHLIGHTS

1 Continuous closure is faster than interrupted.

2 Interrupted closure reduces risk ofinfection.

3 Continuous method offers better tensilestrength.

4 Interrupted technique allows for betterflexibility

5 Wound healing time varies betweenmethods.

ARTICLE INFO

Handling Editor: Dr. S. K. Singh

Key words:
Fascial closure
Suture closure
Laparotomy
Wound infections
Wound dehiscence

ABSTRACT

This study compares the effectiveness of continuous and interrupted fascial closure techniques in midline laparotomy wounds. Conducted over two years at the NRI Institute of Medical Sciences, the study involved 60 patients randomized into two groups of 30. Each patient underwent either continuous or interrupted suture closure using non-absorbable no. 1 prolene suture material. The primary aim was to evaluate post-operative complications such as wound infection, seroma formation, and wound dehiscence. Results indicated that the continuous closure technique was associated with higher rates of post-operative wound infection (33.3% vs. 13.3%) and seroma formation (36.7% vs. 10%) compared to the interrupted closure technique. Wound gaping and dehiscence were also more prevalent in the continuous closure group (28.1% and 30%, respectively), with statistically significant differences ($p<0.05$). The interrupted closure technique demonstrated superior effectiveness in reducing these complications. The follow-up period ranged from 7 to 14 months, during which no cases of incisional hernia were observed. These findings align with previous research, highlighting the increased risk of wound dehiscence in emergency laparotomies and patients in their 40s. Male patients exhibited a higher incidence of dehiscence, potentially due to a higher prevalence of risk factors such as peptic ulceration and intestinal obstruction. In conclusion, the interrupted suturing technique is associated with lower rates of wound dehiscence and related complications, suggesting it as the preferred method for midline laparotomy wound closure. These findings support the use of interrupted suturing for reducing post-operative complications. Further studies are recommended to explore the long-term outcomes of these techniques, ensuring the continued improvement of surgical practices and patient care in midline laparotomy wound management.

* Corresponding author.
Dr. Savalam Bujjitha Rathna Kishore, Associate Professor, Department of General Surgery, Rangaraya Medical College
Received 12 May 2024; Received in revised form 13 June 2024; Accepted 21 June 2024

INTRODUCTION

Midline laparotomy is a commonly employed surgical procedure for accessing the abdominal cavity and peritoneum. Although the use of laparotomy has significantly declined with the development of minimally invasive surgeries, its relevance persists in specific scenarios where such techniques are insufficient. Traditional midline laparotomy continues to be preferred when rapid entry to the peritoneal cavity is necessary. This approach enables swift abdominal exploration with minimal blood loss, and allows for the identification of hidden injuries that some imaging methods may not detect[1,2].

The prevalence of laparotomy has declined due to advancements in minimally invasive and robotic surgeries, as well as a growing preference among patients for elective procedures[3]. A major factor contributing to this decrease is the higher incidence of wound complications associated with laparotomy, such as acute wound dehiscence and late-onset incisional hernias. Consequently, the selection of an appropriate wound closure technique is crucial to prevent these adverse outcomes. Various approaches to both opening the abdomen and closing the wound have been explored, often yielding conflicting results[4].

Wound dehiscence is notably more prevalent in India, often attributed to poor nutritional status and the delayed presentation of patients with peritonitis compared to more developed countries. Various factors contribute to suboptimal wound closure, including the suturing technique, the type of suture material used, and the presence of sepsis and malnutrition. A key risk factor identified for wound dehiscence is impaired collagen synthesis, which directly correlates with reduced collagen formation and the subsequent development of unstable scars. Additional risk factors include obesity, smoking, steroid therapy, and the presence of connective tissue diseases[5,6,7].

Given the significant complications associated with wound dehiscence, this study was initiated to compare the effectiveness of different surgical techniques in preventing burst abdomen and incisional hernia[8,9,10]. The research aims to assess the risk of wound dehiscence and examine various contributing factors. By selecting this topic, the study seeks to contribute valuable insights to existing literature and help mitigate the risks of incisional hernia and burst abdomen in midline laparotomies performed at the NRI Institute of Medical Sciences in Chinakakani, Mangalagiri, Andhra Pradesh.

This study aims to estimate the incidence of wound dehiscence and incisional hernia in midline laparotomies using continuous versus interrupted suturing techniques, evaluate the outcomes of these two techniques in relation to burst abdomen and incisional hernia, and measure the risk of wound dehiscence, wound infections, and seroma formation associated with both suturing methods.

MATERIALS AND METHODS

The study was designed as an interventional prospective study, focusing on the assessment and comparison of surgical techniques in real-time with an aim to identify effective strategies for improving patient outcomes.

The study was conducted over a period of two years, from November 2019 to October 2021, involving patients admitted to the general surgery and emergency departments at the NRI Institute of Medical Sciences, located in Chinakakani, Mangalagiri, Andhra Pradesh.

STUDY POPULATION

The study population consisted of 60 patients randomly selected from those undergoing elective and emergency midline laparotomy. These patients were divided into two groups of 30 each, utilizing a non-probability sampling method to ensure each group was adequately represented for comparative analysis.

The study included patients who were 15 years of age or older, undergoing either elective or emergency midline laparotomy, and who consented to participate. Exclusion criteria were set to omit patients under 15 years, pregnant women, those with prior abdominal surgery, and anyone on medications or therapies that could potentially influence the study outcomes. Structured questionnaire, adapted based on variables from prior research.

DATA ANALYSIS

Data for the study was entered into MS Excel 2016 and analyzed using SPSS Software version 20. The findings were presented in various formats including tables, bar diagrams, and pie charts to illustrate the distributions and relationships clearly. Bivariate analysis was conducted using the chi-square test, with statistical significance set at a p-value of less than 0.05. Outcome measures were quantified using odds ratios, accompanied by a 95% confidence interval to assess the risk associated with each suturing technique.

RESULTS

The majority of the patients, 51.7%, were aged between 41 and 60 years, followed by those aged 26 to 40 years, who comprised 26.7% of the study population. Patients in the 15 to 25-year age group made up 15%, and those older than 60 years accounted for 6.7%.

Table 1: Age group wise distribution

Age Group	Number	%
15 – 25	9	15.0
26 – 40	16	26.7
41 – 60	31	51.7
> 60	4	6.7
Total	60	100

Table no.1 presents the distribution of individuals across different age groups as follows: the 15 – 25 years group comprises 9 individuals, representing 15.0% of the total population; the 26 – 40 years group includes 16 individuals, making up 26.7% of the total; the 41 – 60 years group is the largest, with 31 individuals accounting for 51.7% of the total population; and the above 60 years group, being the smallest, consists of 4 individuals, constituting 6.7% of the total. In summary, the table covers a total of 60 individuals, equating to 100% of the population surveyed, with the 41 – 60 years age group having the highest representation and the above 60 years group the lowest.

Table 2: Type of Surgery

Surgery	No.	%
Emergency	48	80.0
Elective	12	20.0
Total	60	100.0

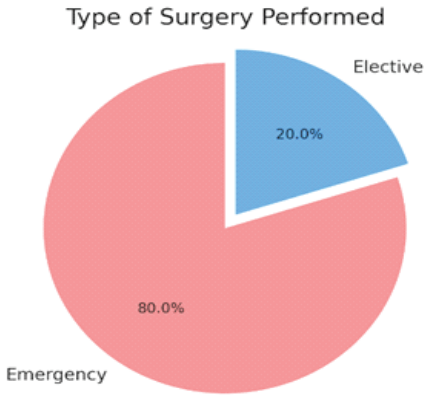

Figure 2: Type of Surgey

Figure 2. the pie chart illustrating the distribution of emergency and elective surgeries. As shown, 80% of the surgeries were emergency, while 20% were elective.

Table no.2 illustrates the distribution of surgeries by type, showing that out of a total of 60 surgeries, 48 were emergency surgeries, accounting for 80.0% of the total, while 12 were elective surgeries, making up the remaining 20.0%. This indicates a significantly higher prevalence of emergency surgeries compared to elective ones.

Table 3: Wound Infection

Suturing Method	Wound Infection				Total	
	Present		Absent			
	No.	%	No.	%	No.	%
Continuous	10	33.3	20	66.7	30	100
Interrupted	4	13.3	26	86.7	30	100
Total	14	23.3	46	76.7	60	100
Chi – square value = 3.35, p value = 0.067, Not Significant						

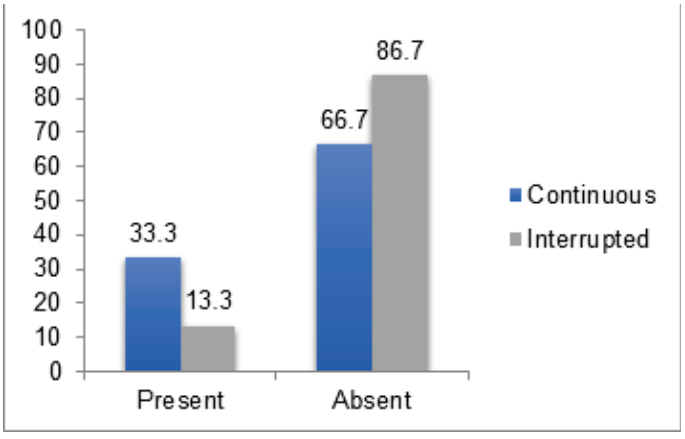

Figure 3: Wound Infection (%)

Table no.3 presents data on wound infections associated with two different suturing methods. The table shows that out of 30 wounds sutured using the continuous method, 10 (33.3%) developed infections, while 20 (66.7%) did not. In contrast, of the 30 wounds sutured using the interrupted method, 4 (13.3%) developed infections, and 26 (86.7%) did not. Overall, for the 60 wounds, 14 (23.3%) had infections, and 46 (76.7%) did not. The chi-square value is 3.35 with a p-value of 0.067, indicating that the difference in wound infection rates between the two suturing methods is not statistically significant.

Table 4: Seroma formation

Suturing Method	**Seroma formation**				**Total**	
	Present		**Absent**			
	No.	%	No.	%	No.	%
Continuous	11	36.7	19	63.3	30	100
Interrupted	3	10.0	27	90.0	30	100
Total	14	23.0	46	76.7	60	100
Chi – square value = 5.96, p value = 0.015, Significant *						

Table no.4 presents data on seroma formation associated with two suturing methods. Out of 30 cases using the continuous method, 11 (36.7%) had seroma formation, while 19 (63.3%) did not. In contrast, for the interrupted method, 3 out of 30 cases (10.0%) developed seromas, and 27 (90.0%) did not. Overall, in the 60 cases, 14 (23.3%) experienced seroma formation, and 46 (76.7%) did not. The chi-square value is 5.96 with a p-value of 0.015, indicating a statistically significant difference in seroma formation between the two suturing methods.

Figure 4: Showing Seroma formation

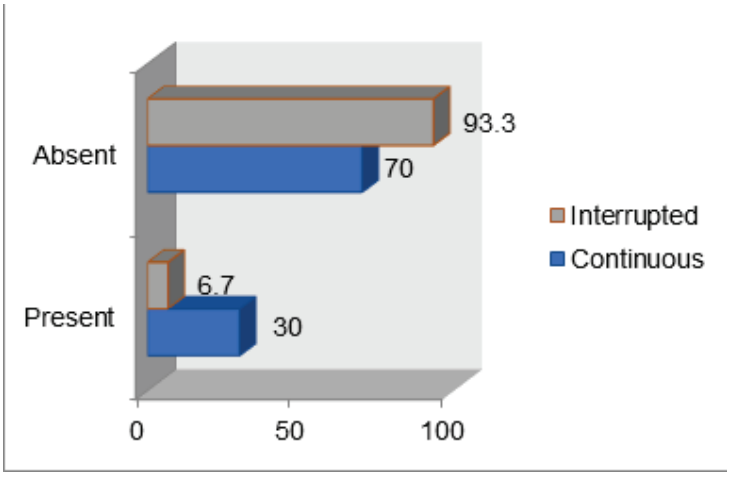

Figure 5. Graph no.5: Wound dehiscence (%)

Graph no.5 illustrates the percentage of wound dehiscence occurrences associated with continuous and interrupted suturing methods. The graph shows that wound dehiscence was present in 30% of cases using the continuous method, while it was significantly lower at 6.7% for the interrupted method. Conversely, wound dehiscence was absent in 70% of continuous suturing cases and in 93.3% of interrupted suturing cases. This suggests a higher rate of wound dehiscence with the continuous method compared to the interrupted method.

Table 3. Pain Levels (Visual Analog Scale, 0-10)

Days of stay	
Average	19 days
Range	6 – 36 days

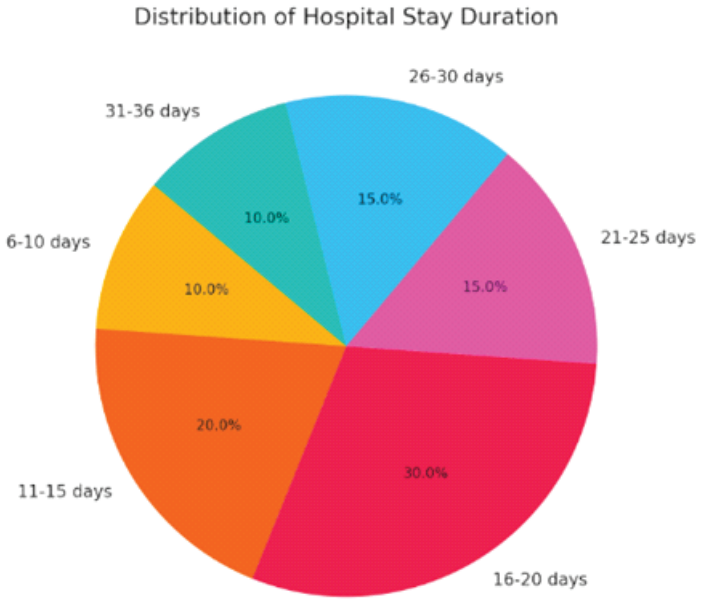

Figure 6. The pie chart representing the hypothetical distribution of hospital stay durations within the specified range of 6 to 36 days. The chart provides a visual representation of the proportion of patients staying within different duration brackets.

Table no.6 provides information on the duration of hospital stays for patients. The average length of stay is 19 days, with a range spanning from a minimum of 6 days to a maximum of 36 days. This indicates that while the typical hospital stay is about 19 days, there is considerable variability in the duration of stay among patients.

DISCUSSION

In the present study, a total of 60 patients who had undergone midline laparotomies for various indications were randomized into two groups of 30 each to effectively compare continuous and interrupted suture closing techniques. All cases were closed with non-absorbable no. 1 prolene suture material, and the skin was closed directly after the rectus sheath without subcutaneous tissue closure. The majority of the patients were in the age group of 41 – 60 years (51.7%), followed by 26 – 40 years (26.7%). This is consistent with a study by Vardhini KV et al. (2018), which reported that the average age group was 45 – 60 years, with the highest incidence of burst abdomen occurring in the 51 – 60 years age group. Similarly, G. Lakshmi et al. (2018) found that most patients were above 30 years old, with the highest incidence of wound dehiscence in the 50 – 60 years age group (24.2%). Ramneesh G et al. (2014) also noted a higher incidence of wound dehiscence in the 4th decade of life. Agrawal CS et al. (2014) reported a mean patient age of 36.09 years and a median of 32 years, further suggesting a higher incidence of wound dehiscence in the 4th decade of life[11,12,13,14].

In the present study, most midline laparotomies were performed as emergency procedures (80%), with only a minor proportion being elective (20%). Similar findings were reported by Vardhini KV et al. (2018) and Odiya S et al. (2017), indicating a higher use of emergency surgery for laparotomies. G. Lakshmi et al. (2018) also reported a higher risk of burst abdomen (72.72%) in patients undergoing emergency laparotomies. Kapoor KK et al. (2017) found that 87% of their patients had emergency surgeries. These results collectively indicate a higher risk associated with emergency surgeries for midline laparotomies[15,16,17].

The present study observed that post-operative wound infection rates were higher in the continuous closure technique group (33.3%) compared to the interrupted closure technique group (13.3%), although the difference was not statistically significant ($p>0.05$). Similarly, a study by Pavlidis TE et al. (2001) reported a tenfold increase in wound dehiscence rates due to wound infection, with the most common organisms isolated being

Staphylococcus aureus, Escherichia coli, and Pseudomonas[18].

The study found a higher incidence of seroma formation in the continuous closure technique group (36.7%) compared to the interrupted closure technique group (10%), with this difference being statistically significant ($p<0.05$). Wound gaping was also significantly more associated with the continuous closure technique (28.1%) ($p<0.05$). Additionally, there were increased rates of wound dehiscence in patients sutured using the continuous closure technique (30%) with a significant difference ($p<0.05$). The risk of wound dehiscence was 1.9 times higher with the continuous closure technique compared to the interrupted closure technique [RR – 1.9; 95% CI 1.24 – 2.92, p value = 0.003* ($p<0.05$)].

A study by Bansiwal RK et al. (2019) among 300 patients who underwent emergency midline laparotomy reported a wound dehiscence rate of 20.1% in the continuous suture group, compared to only 5.4% in the interrupted group. Several studies in India have similarly indicated that the risk of wound dehiscence is significantly lower with the interrupted closure technique compared to the continuous closure technique. In contrast, several Western studies have reported no significant difference in burst abdomen rates between the two techniques, with some even finding lower rates with the continuous closure technique. The increased incidence of wound dehiscence in Indian patients may be due to poor clinical profiles at the time of presentation during emergency laparotomies, resulting in a necrotic linea alba that is prone to cutting out with coughing or sneezing[19,20].

In the present study, the follow-up period ranged from a minimum of 7 months to a maximum of 14 months, during which no cases of incisional hernia were observed among the participants. In contrast, a one-year follow-up study by Hegazy et al. (2020) identified factors associated with the incidence of incisional hernia in midline laparotomies, revealing that a history of previous laparotomy significantly contributed to higher rates of incisional hernia, with an incidence of 29% in such patients[21].

Significant rates of wound dehiscence and subsequent development of incisional hernia have been observed in patients with diabetes, particularly those with uncontrolled diabetes, in numerous studies. Mahey et al. (2016) reported diabetes mellitus as the most common comorbid condition (42%) associated with incisional hernia in their prospective study on risk factors for wound dehiscence. Similarly, Jaiswal et al. (2018) found higher incidences of wound dehiscence and incisional hernia among diabetic patients (29%). Kotwal et al. (2018) also reported a higher incidence of incisional hernia in diabetic patients in their study on predicting factors of burst abdomen. The possible mechanisms include diabetes causing low wound oxygenation due to poor perfusion and ischemia, which leads to prolonged inflammation and increased incidence of incisional hernia. Additionally, high levels of matrix metalloproteases in diabetic patients can result in tissue destruction, further contributing to the increased incidence of incisional hernia[22,23,24].

CONCLUSION

Wound dehiscence, or burst abdomen, is a significant cause of postoperative morbidity in patients undergoing midline laparotomy, particularly in emergency surgical procedures. A higher incidence of wound dehiscence was observed in the 4th decade of life, with males at higher risk due to a greater incidence of laparotomies linked to risk factors such as peptic ulceration and intestinal obstruction. Most midline laparotomies across studies were performed on an emergency basis. A highly significant association was found between wound dehiscence and the continuous closure technique compared to the interrupted suturing technique. Continuous closure was also significantly associated with wound complications such as infection, seroma formation, and wound gaping, indicating the superior effectiveness of the interrupted suturing technique in reducing wound dehiscence. However, this difference was not consistent with the incidence of incisional hernia, which was not influenced by the type of suturing method. Burst abdomen typically presented between 6 to 10 days postoperatively, a finding consistent across most studies. The study concludes that the interrupted suturing technique is associated with lower rates of wound dehiscence and related complications such as wound infection, seroma formation, and wound gaping.

Conflict of interest: There is no any conflict of interest among the authors.

REFERENCES

1. Borab ZM, Shakir S, Lanni MA, Tecce MG, MacDonald J, Hope WW, Fischer JP. Does prophylactic mesh placement in elective, midline laparotomy reduce the incidence of incisional hernia? A systematic review and meta-analysis. Surgery. 2017 Apr 1;161(4):1149-63.
2. Philips PA, Amaral JF. Abdominal access complications in laparoscopic surgery. Journal of the American College of Surgeons. 2001 Apr 1;192(4):525-36.
3. Ferrari D, Violante T, Novelli M, Starlinger PP, Smoot RL, Reisenauer JS, Larson DW. The death of laparoscopy. Surgical endoscopy. 2024 May;38(5):2677-88.
4. Zelhart M, Kaiser AM. Robotic versus laparoscopic versus open colorectal surgery: towards defining criteria to the right choice. Surgical Endoscopy. 2018 Jan;32:24-38.
5. Latha M. A Clinical Study on Wound Dehiscence in Patients Undergoing Emergency Exploratory Laparotomy (Doctoral dissertation, Kilpauk Medical College, Chennai).
6. Chudar A. A Clinical study of Abdominal Wound Dehiscence (Doctoral dissertation, Tirunelveli Medical College, Tirunelveli).
7. Patel PN. Clinical Study of Various Comorbidities that Lead to Abdominal Wound Dehiscence Following Emergency Laparotomy (Doctoral dissertation, Rajiv Gandhi University of Health Sciences (India)).
8. Petersson P, Montgomery A, Petersson U. Wound dehiscence: outcome comparison for sutured and mesh reconstructed patients. Hernia. 2014 Oct;18:681-9.

9. Sudish D. Efficacy of abdominal risk model in predicting the probability of wound dehiscence (Doctoral dissertation, Coimbatore Medical College, Coimbatore).
10. Giridharan R. Prospective study of Comparison of Use of Subcutaneous Drains to Prevent Wound Complications in Emergency Laprotomy Procedures (Doctoral dissertation, Madurai Medical College, Madurai).
11. Seiler CM, Deckert A, Diener MK, Knaebel HP, Weigand MA, Victor N, Büchler MW. Midline versus transverse incision in major abdominal surgery: a randomized, double-blind equivalence trial (POVATI: ISRCTN60734227).
12. Cowlishaw PJ, Kotze PJ, Gleeson L, Chetty N, Stanbury LE, Harms PJ. Randomised comparison of three types of continuous anterior abdominal wall block after midline laparotomy for gynaecological oncology surgery. Anaesthesia and Intensive Care. 2017 Jul;45(4):453-8.
13. Vardhini KV, Kishan D. Incidence and risk factors influencing morbidity and mortality in cases of burst abdomen after emergency and elective midline laparotomies. International Surgery Journal. 2018 Oct 26;5(11):3471-7.
14. Lakshmi G, Beena R, Soni KB, Viji MM, Jha UC. Exogenously applied plant growth regulator protects rice from heat-induced damage by modulating plant defense mechanism. Journal of Crop Science and Biotechnology. 2023 Jan;26(1):63-75.
15. Lakshmi G, Beena R, Soni KB, Viji MM, Jha UC. Exogenously applied plant growth regulator protects rice from heat-induced damage by modulating plant defense mechanism. Journal of Crop Science and Biotechnology. 2023 Jan;26(1):63-75.
16. Odiya S, Hedau S, Raghuwanshi RK, Khare E. Comparative study between continuous suture and interrupted suture in laparotomy wound repair. J Evol Med Dent Sci. 2017 Aug 14;6:4720-3.
17. Sharma V, Sharma T, Kaul S, Kapoor KK, Dhar MK. Anticancer potential of labdane diterpenoid lactone “andrographolide” and its derivatives: a semi-synthetic approach. Phytochemistry Reviews. 2017 Jun;16:513-26.
18. Pavlidis TE, Galatianos IN, Papaziogas BT, Lazaridis CN, Atmatzidis KS, Makris JG, Papaziogas TB. Complete dehiscence of the abdominal wound and incriminating factors. The European journal of surgery. 2001 May 1;167(5):351-4.
19. Bansiwal RK, Mittal T, Sharma R, Gupta S, Singh S, Abhishek K, Attri AK. Comparative study of abdominal wound dehiscence in continuous versus interrupted fascial closure after emergency midline laparotomy. International Surgery Journal. 2019 Feb 25;6(3):886-91.
20. Bala Brindha S. Comparison between Continuous Versus Modified Continuous Smead Jones Technique of Suturing in Closure of Rectus in Patients Undergoing Emergency Laparotomy in a Tertiary Care Centre: A Randomized Controlled Trial (Doctoral dissertation, Madras Medical College, Chennai).
21. Tran DD, Vafaeipour M, El Baghdadi M, Barrero R, Van Mierlo J, Hegazy O. Thorough state-of-the-art analysis of electric and hybrid vehicle powertrains: Topologies and integrated energy management strategies. Renewable and Sustainable Energy Reviews. 2020 Mar 1;119:109596.
22. Mahey R, Kriplani A, Mogili KD, Bhatla N, Kachhawa G, Saxena R. Randomized controlled trial comparing ferric carboxymaltose and iron sucrose for treatment of iron deficiency anemia due to abnormal uterine bleeding. International Journal of Gynecology & Obstetrics. 2016 Apr 1;133(1):43-8.
23. Jaiswal NK, Shekhar S. Study of burst abdomen: it's causes and management. International Surgery Journal. 2018 Feb 26;5(3):1035-40.
24. Amilia OG, Komar H. Description of Post-Laparotomy Patients with Wound Dehiscence From 1st January 2019–31th December 2019 at Dr. Mohammad Hoesin General Hospital. Sriwijaya Journal of Surgery. 2021 Apr 23;4(1):245-52.