

Efficacy of Polydioxanone and Olypropylene Suture on Midline Laparotomy Wound Closer

Himani Sandhu¹, Santhosh Kumar Elaveree E², Akshay Nagare³, Ravi Sinha⁴, Rohit Singh⁵, Biswajit Maity⁶

¹JR-3, Department of General Surgery, Hind Institute of Medical Sciences, Mau Ataria, U.P.

²JR-3, Department of General Surgery, Hind Institute of Medical Sciences, Mau Ataria, U.P.

³JR-3, Akshay Nagara, Department of General Surgery, Hind Institute of Medical Sciences, Mau Ataria, U.P.

^{4*} Associate Professor, Department of General Surgery, Hind Institute of Medical Sciences, Mau Ataria, U.P.

⁵ Assistant Professor, Department of General Surgery, Hind Institute of Medical Sciences, Mau Ataria, U.P.

⁶ Associate Professor, Department of Biochemistry & Head, Research & Development, Hind Institute of Medical Sciences, Mau

Received: 25-08-2023 / Revised: 28-09-2023 / Accepted: 30-10-2023

Corresponding author: Dr. Ravi Sinha

Conflict of interest: Nil

Abstract:

Background: Type of suture material used for fascial closure in laparotomies influences the incidence of postoperative complications. Currently there is no consensus on the superiority of either absorbable or non-absorbable suture materials for abdominal fascial closure. Aim of this study was to determine the superior suture material for abdominal wall closure after elective laparotomy among polypropylene and polydioxanone based on the occurrence of specific post-operative complications.

Aim: To study the comparative efficacy and outcome of absorbable suture polydioxanone and non-absorbable suture polypropylene in midline laparotomy wound closure.

Material & Methods

Study Area: Hind Institute of Medical Sciences, Mau Ataria, Sitapur, U.P., India

Study Design: Analytical study. Study Groups: Two Groups. Sample size: 40 in each group.

Results: Group A - patients with even numbers in which abdominal incisions are closed with absorbable suture material polydioxanone and Group B-patients with odd numbers in which abdominal incisions are closed with non-absorbable suture material polypropylene. Age-wise and Gender-wise a non-significant difference was observed among groups [p=0.9650], [p=0.1596] respectively. Serum amylase & serum lipase level were also found non-significant but the prothrombin concentration and INR were found significantly higher in group A as compared to group B. Significantly higher difference in group A was also observed in platelet count only in CBC [p=0.0004*]. The KFT showed higher levels of calcium, sodium, chloride, potassium and blood urea in group A as compared to group B, but statistically, a significant difference was observed in calcium [p=0.0085*] and sodium level [p=0.0042*] among the group. A non-significant difference was observed among groups on LFT values. In group A, Serosanguinous discharge was noted in only 1 patient, while in group B, it was observed in 5(12.50%) patients. Abdominal distension was also noted in group A in 1 patient only, whereas, in group B, it was observed in 7(17.50%) patients. Statistically, a significant difference was observed in the burst abdomen [p=0.0402*] and abdominal distension [p=0.0253*]. In Group A only 2 patients had pain and suture sinus formation and in group B, 7 patients had pain, and 8 had suture sinus formation. Statistically, a significant difference was observed among the groups.

Conclusion: Based on the findings of this study, it has been determined that the continuous mass closure technique employing, Polydioxanone (PDS) suture material was superior to Polypropylene (PPL) suture material in preventing wound complications.

Keywords: Polypropylene (PPL), Polydioxanone (PDS), Suture Material, midline laparotomy, wound closure.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

The technique of closure of the abdomen after a surgery has often been a topic of debate. An ideal closure should be easy, provide adequate strength and act as a barrier for the infection. It should be tension free, to avoid ischemia and the closure should be comfortable for the patient [1]. Midline (MI) and transverse (TI) incisions are the most common because they provide optimum access in the majority of instances and can be easily extended as needed [2]. Laparotomy wound related complications are a major source of post-operative morbidity. These include wound infections, incisional hernias and burst abdomen (wound dehiscence). Hence, the closure must be effective executed without strain or ischemia, patient-friendly, and aesthetically pleasing [3]. The most important debate in choosing suture material for fascial closure after a laparotomy is between nonabsorbable and delayed absorbable suture materials. There are proponents of both absorbable and nonabsorbable suture materials for abdominal wall closure. Though non-absorbable sutures (nylon and polypropylene) have been the preferred choice traditionally, the advent of polydioxanone has brought a wave of popularity for absorbable sutures. Nowadays, the most common closure technique for midline laparotomy is a mass closure using delayed absorbable suture (polydioxanone- PDS). Non-absorbable sutures are recommended due to their high tensile strength and inability to be dissolved by the body's during natural healing. Non-absorbable sutures are typically used to close superficial wounds, but absorbable sutures can be utilised to create a double-layer closure for deeper wounds. Thus, absorbable sutures aid in reducing tension and improving wound edge approximation. This will result in a reduced risk of wound dehiscence and a more visually attractive wound closure [4]

A midline laparotomy necessitates the opening of the linea alba, a tendinous zone of the abdominal wall where the fibres of the muscular fascia on either side of the linea alba intersect. When the fibres of the linea alba are sectioned vertically to get access to the peritoneal cavity, the fragility of the linea alba increases. Thus, while repairing or closing the linea alba with sutures, these are susceptible to the stress caused by the mechanical forces acting on it. These forces are caused by the intra-abdominal pressure and the muscle complex consisting of the lateral abdominal muscles, whose fascias converge at the linea alba and tend to separate the borders of the surgical incision. This mechanical aspect and other biological factors are responsible for the high incidence of postoperative incisional hernia, which was reported to impact 16 to 20 percent of cases [5].

There are two different types of sutures: absorbable and non-absorbable. Polypropylene and polydioxanone are the two most popular suture

materials used to close a midline incision. The former is very biocompatible and non-absorbable, whereas polydioxanone is a mid- to long-lasting absorbable polymer substance (for around 180-230 days). Recently, several new suture types, including non-absorbable and absorbable polymers with elastic qualities, have been developed [6].

Incisional hernia (IH) is the complication laparotomy, with an incidence of 10-23%, however this can reach to 40% in certain risk categories. IH is frequently asymptomatic; nonetheless, in certain people it is a major cause of morbidity (pain) and has a detrimental impact on the patient's quality of life and body image [7]. Current recommendations for abdominal wall closure were established by the European Hernia Society (EHS): avoid the midline as much as possible, perform continuous suturing, avoid the use of rapidly absorbable suture materials, suture in a single layer without closing the peritoneum, and follow the Jenkins 4:1 rule (suture length/wound length) [8].

Numerous investigations on closing abdominal fascia with various Sutures have been undertaken, including knot tying, suture handling, cost effectiveness, strength, and susceptibility[9]. Durability of tensile strength is also a criterion that must be considered, and it is the most crucial.

A quasi-experimental study on 36 patients to assess the local wound complications in complicated/ high risk laparotomies in terms of wound dehiscence and incisional hernia formation with a modified technique of midline abdominal wound closure. Twenty (55.55%) of the 36 patients had inflammatory/intra-abdominal sepsis, eight (22.22%) had trauma, seven (19.44%) had neoplasia, and one (2.775%) had a vascular cause. One individual (2.77%) suffered partial wound dehiscence, and one individual (2.77%) developed an incisional hernia. In 12 (33.33%) cases, wound infection was seen; 4 (11.11%) patients complained pain over subcutaneous palpable knots and 3 (8.33%) patients developed sinus due to the knots. Thus, it was determined that patients with broad, widespread, generalised peritonitis and metastatic abdominal tumours require extra attention when it comes to wound closure [10].

A prospective, randomised study assessed suture materials for fascia closure following abdominal surgery in 456 participants. Following closure with non-absorbable Prolene, 223 patients were analysed, and 233 after closure with absorbable polydioxanone (PDS). It was revealed that there was no significant difference between the groups in the incidence of incisional hernia. Secondary outcome assessments revealed no statistically significant changes. In both groups, the incidence of incisional hernia was higher than anticipated by previous

research. No notable differences existed between the two suture techniques [11].

A prospective and comparative study on 284 patients to evaluate differences in midline laparotomy closure with a standard closure technique and new-fangled slow- absorbable versus non-absorbable sutures. It was reported that there were no notable distinctions between these two contemporary sutures. It appears that advancements in suture materials have resulted in a step toward the aims of a useful suture, and complications of surgical wound closure should now be a simple issue of operative technique. In conclusion, the choice of suture material should be determined by the patient, wound, tissue properties, and anatomic position [12].

The polydioxanone and polypropylene suture material for abdominal fascial closure regarding morbidity in terms of post-operative wound complications was compared. In comparison to polydioxanone, polypropylene suture material was associated with a higher incidence of wound discomfort in both the immediate and delayed post-operative periods. Compared to PDS, polypropylene had a greater incidence of wound infection. In this study, there were 4% incidences of wound dehiscence. In the delayed postoperative period, the incidence of suture sinus formation was greater with polypropylene suture material than with polydioxanone suture material. The polypropylene suture material had a higher incidence of perceptible knots than the polydioxanone suture material. No cases of incisional hernia have been recorded with the use of polydioxanone sutures. In the Polydioxanone group, total morbidity from abdominal closure was significantly reduced. Reported reductions in wound complications such as abdominal rupture, wound infection, wound discomfort, suture sinus development, perceptible knots, and incisional hernia. Therefore, polydioxanone can be utilised profitably in emergency situations where quick and safe closure is possible [13].

The non-absorbable sutures (nylon) and delayed absorbable sutures polydioxanone for abdominal wall closure in cases of peritonitis was also reported and it was found that the rates of wound discomfort, discharge, and dehiscence were 30%, 23.3%, and 26.7% in group A and 6.7%, 16.6%, and 23.7% in group B, respectively, of the 60 patients. In group A, there were no cases of abdominal rupture, compared to one in group B[14].

A total of 100 patients were screened to determine the superior suture material for abdominal wall closure after elective laparotomy among polypropylene and polydioxanone based on the occurrence of specific post-operative complications. There was no difference between the two groups in

terms of surgical site infection. In addition, there was no statistically significant difference between the two groups in terms of abdominal rupture and incisional hernia. Comparing early and late post-operative problems, there was no statistically significant difference between Prolene and Polydioxanone. Consequently, either of the two suture materials may be utilised to close abdominal wounds in elective midline laparotomies [15].

Two suture materials, the non-absorbable polypropylene and the slowly absorbable Polydioxanone for abdominal closure were compared. It was reported that wound sinus formation was significant in the polypropylene group, while hernia results were insignificant. It was determined that polydioxanone appears to have the same tensile strength as polypropylene and may not form wound sinuses [16].

The outcome of interrupted abdominal closure and continuous abdominal closure in midline laparotomy wound has been reported in a study. The rate of wound infection and ruptured abdomen were found to be comparable, and only a few individuals had suture sinus. One patient additionally reported an incisional hernia. Thus, it was determined that the continuous technique of midline laparotomy wound closure is superior in terms of time required for wound closure and cost of suture materials, although wound infection, abdominal rupture, and late wound sequelae were comparable[17].

The superior suture material for abdominal wall closure after surgery among polydioxanone and polypropylene based on the post-operative length of hospital stay and development of incisional hernia were also reported. There were substantial differences between groups in terms of hospital stay and incisional hernia formation. In the polydioxanone group, the incidence of incisional hernia and length of hospital stay after surgery owing to wound closure were significantly reduced [18].

A three years of follow-up of the use of the reinforced tension line (RTL) technique was compared with primary suture only (PSO) closure in the prevention of IH in high- risk patients undergoing laparotomy. A total of 124 patients were assigned at random. In the PSO group, the incidence of IH was greater than in the RTL group. During follow-up, the groups had comparable incidences of surgical site infection, hematoma, seroma, and postoperative discomfort. RTL is superior to PSO in preventing intrahepatic haemorrhage in high-risk midline laparotomy patients, and it is not related with a higher incidence of sequelae [19]. Hence, in view of above reports, the comparative wound complication rates of absorbable suture polydioxanone vs non-absorbable suture polypropylene in midline laparotomy wound closure

was taken for better understanding of patients comforts.

Therefore, the objectives of this study was to compare the rate of occurrence of the following post-operative complications after abdominal wall closure using polypropylene or polydioxanone-Surgical site infection, burst abdomen and incisional hernia.

Aim and Objectives:

Aim

To determine the wound complication outcome of absorbable suture polydioxanone and non-absorbable suture polypropylene in midline laparotomy wound closure.

Objectives:

- Primary Objective: To evaluate complication associated with wound closure.
- Secondary Objective: To evaluate risk factor associated with wound closure.

Material and Methods:

Study Area: Hind Institute of Medical Science, Mau Ataria, Sitapur

Study Design: Analytical study

Study duration: 18 months after obtaining HIMS IHEC'S Approval.

Sample size: 40 (In each group), Group A= non-absorbable suture material polypropylene and Group B = absorbable suture material polydioxanone

Patient were followed up at interval of 2 weeks,4 weeks then once in 3 months and up to 1year to know wound complications such as, wound infections, sinus formation, wound dehiscence, incisional hernia, burst abdomen and pain at suture site.

Methods: All patients who were operated on by midline laparotomies during the study period (except those who fall in the exclusion criteria] were selected. Further, we divide all patients into two groups according to absorbable and non- absorbable sutures. Patients underwent both elective and emergency laparotomies through midline vertical incisions. Equal number of cases was studied for closure with these two suture materials; polydioxanone (PDS) and polypropylene (PPL) suture material. Data was collected based on postoperative wound complications, including postoperative wound pain, wound infection, wound dehiscence, suture sinus formation, stitch granuloma and incisional hernia.

Sampling Method:

Preoperative investigations are essential for the pre-anaesthetic evaluation and fitness for surgery. These included –

- Serum amylase/ Serum lipase
 - PT/PC/INR
 - Complete blood count
 - Serum electrolytes
 - Blood sugar
 - Blood urea and serum creatinine
 - Total bilirubin, alkaline phosphatase, SGOT, SGPT
 - Total proteins with serum albumin
 - X-ray erect abdomen
 - Chest X-ray, Electrocardiogram
 - CECT Whole abdomen when required
- * The age and sex-matched patients were divided into group "A" and group "B" by giving odd and even numbers, respectively.
 - * Group-A included the patients with odd numbers in whom abdominal incisions are closed with non-absorbable suture material polypropylene.
 - * Group-B included the patients with even numbers in whom abdominal incisions are closed with absorbable suture material polydioxanone.
 - * Detailed patient history and investigations were done; nature of operation performed was noted in the standard study proforma.
 - * In emergency operations, like peritonitis, fluid from the peritoneal cavity was collected for culture and sensitivity.
 - * Empirical broad-spectrum antibiotic was administered, followed by an antibiotic based on a culture sensitivity test.
 - * Wound was inspected in the immediate postoperative period (DAY-2) for evidence of infection. Discharge, if any, was sent for culture and sensitivity.
 - * Postoperative pain was recorded by using a visual analog scale.

Follow up:

Subsequently, patients were followed up regularly at intervals of 2 weeks, 4 weeks and once in 3 months up to 1 year.

During the subsequent follow-up period, wound pain, infection, dehiscence, suture sinus formation, stitch granuloma, and incisional hernia was inspected and recorded for one year.

Statistical Analysis: All the data was processed by using SPSS v26.0 (SPSS Inc., Chicago, IL, USA). Frequency and percentages were given for age

groups, gender, biochemical parameters and type of operation.

Chi square was used to determine the association of postoperative development of incisional hernia with sutures among two groups.

Independent sample t test was used to compare the mean age and hospital stay between both groups. A p value ≤ 0.05 was considered significant.

Results: All the patients (Gr.A + Gr.B = 40+40) were equally divided into two groups, i.e., Group A

(patients with even numbers in whom abdominal incisions are closed with absorbable suture material polydioxanone) and Group B (patients with odd numbers in whom abdominal incisions are closed with non-absorbable suture material polypropylene).

It has been found that, according to age wise distribution the Group A was [14(35.00%)] and group B was [16(40.00%)]. Statistically, a non-significant difference was observed among groups [p=0.9650].

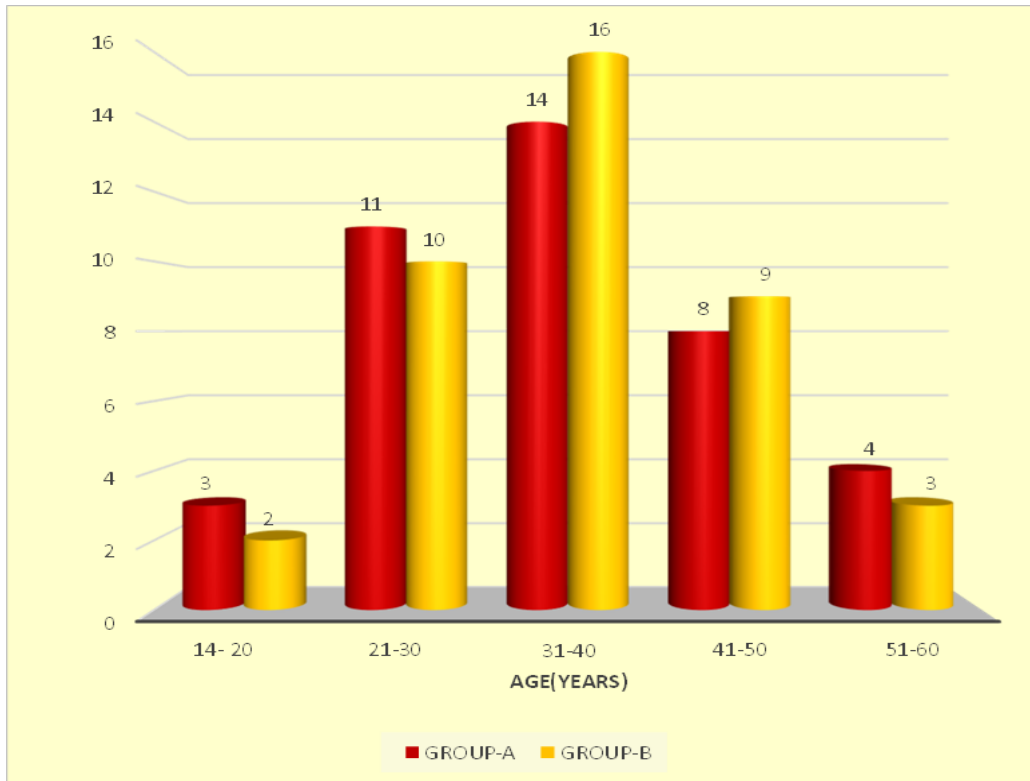


Figure 1: Age-wise distribution of enrolled patients

Male preponderance was observed in both group, A= [29(72.50%)] and group B= 23(57.50%). Statistically, a non-significant difference was observed among the groups [p=0.1596]. It has also been observed that the mean serum amylase level was higher in group B [38.02±6.59] than in group A [37.78±6.63]. At the same time, serum lipase was higher in group A [28.63±5.35] than in group B [28.13±5.25]. Statistically, a non-significant difference was observed among the groups.

Table 1: Coagulation Profile of Enrolled Patients:

COAGULATION PROFILE	GROUP-A [N=40]		GROUP-B [N=40]		P-VALUE
	Mean	SD	Mean	SD	
Prothrombin time (Sec)	12.25	0.89	11.93	0.75	t=1.739 p=0.0860
Prothrombin Concentration (%)	91.53	0.67	91.41	0.42	t=0.9598 p=0.3401
International Normalized Ratio (INR)	0.87	0.07	0.86	0.05	t=0.7352 p=0.4644

Similarly, the mean prothrombin time was higher in group A [12.25±0.89] compared to group B [11.93±0.75]. The prothrombin concentration and INR were also higher in group A compared to group B. Statistically, significant differences were also observed in between the groups.

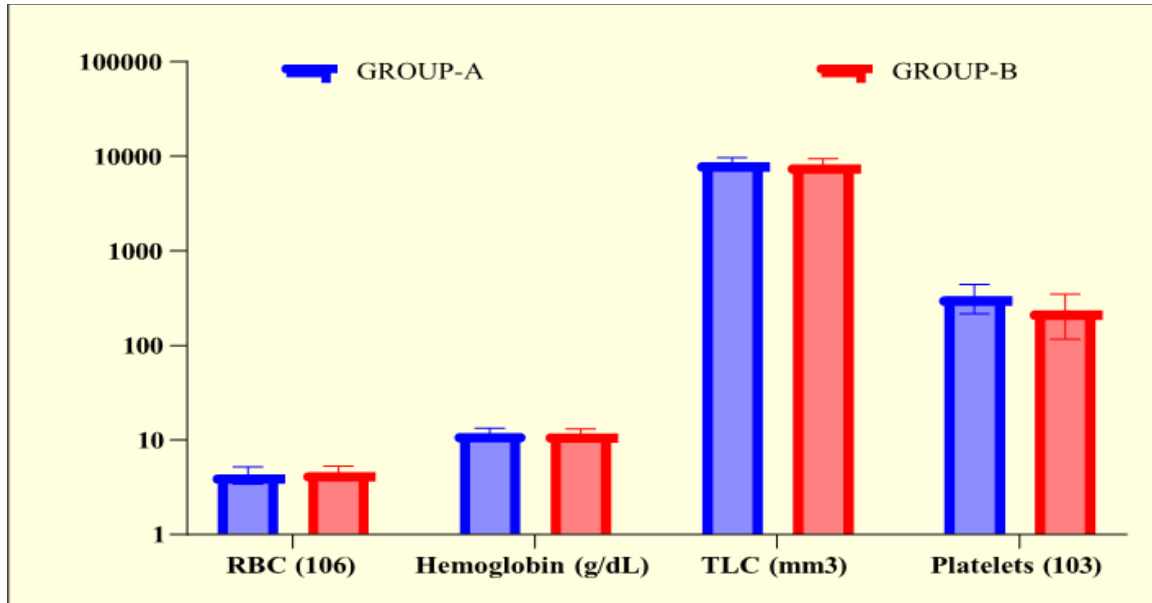


Figure 2: Complete Blood Count of enrolled patients

The mean RBC was higher in group B [4.51±0.77] than in group A [4.28±0.89]. In contrast, the mean TLC was noted higher in group A [8632.3±1129.3] than in group B [8162.7±1276.8]. Statistically, a significant difference was observed in platelet count only [p=0.0004*].

The mean total protein was found to be higher in ingroup B [7.76±1.27] than in group A [7.63±1.88]. At the same time, serum albumin was higher in group A [4.72±1.98] than in group B [4.66±1.98].

Statistically, a non- significant difference was observed among the groups.

The Kidney Function Test (KFT) showed higher levels of calcium, sodium, chloride, potassium and blood urea in group A compared to group B. In contrast, serum creatinine was higher in group B [0.86±0.09] than in group A [0.83±0.07]. Statistically, a significant difference was observed in calcium [p=0.0085*] and sodium level [p=0.0042*] among the group.

Table 2: Kidney Function Test of enrolled patients

KIDNEY FUNCTION TESTS (KFT)	GROUP-A [N=40]		GROUP-B [N=40]		P-VALUE
	Mean	SD	Mean	SD	
Calcium (mg/dL)	1.06	0.02	1.04	0.01	t=5.657 p<0.0001*
Sodium (mmol/L)	139.82	2.78	138.15	2.25	t=2.953 p=0.0042*
Chloride (mmol/L)	103.27	2.52	102.63	2.01	t=1.256 p=0.2130
Potassium (mEq/L)	4.12	0.73	3.98	0.95	t=0.7390 p=0.4621
Blood Urea (mg/dl)	16.62	2.31	15.87	2.87	t=1.288 p=0.2017
Serum Creatinine (mg/dL)	0.83	0.07	0.86	0.09	t=1.664 p=0.1001

The LFT showed a higher mean level of Alkaline phosphatase (ALP) higher in group A [82.93±5.84] than in group B [80.88±6.68]. Although the total bilirubin level, serum glutamic-oxaloacetic transaminase (SGOT) and serum glutamic-pyruvic transaminase (SGPT) were noted higher in group B as compared to group A. Statistically, a non-significant difference was observed among groups.

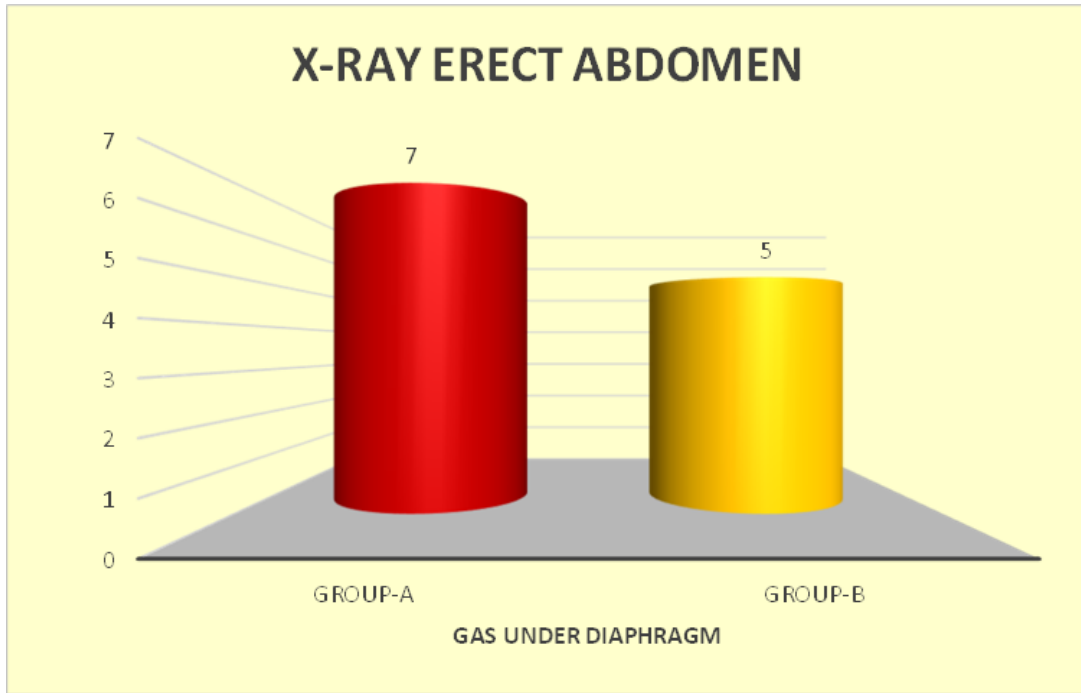


Figure-3: X-ray of the erect abdomen of enrolled patients:

It has been found that the Gas under the diaphragm in 7 pts, (17.50%) of group A and in 5 pts, (12.50%) of group B. Statistically, a non-significant difference was observed in two groups [p=0.5312].

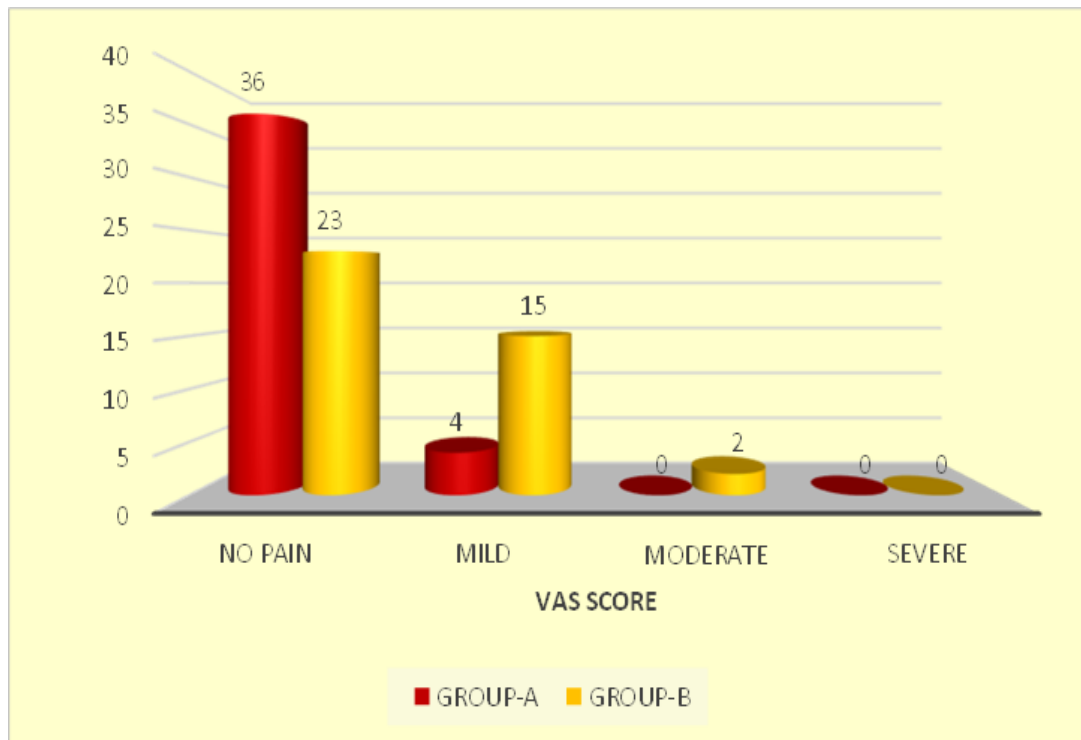


Figure 4: Visual Analogue Scale score (Pain) of enrolled patients :

The majority of the patients had no pain in both group A [36(90.00%)] and group B [23(57.50%)]. In group A, patients only had mild pain [4(10.00%)], while in group B, moderate pain was also experienced by patients [2(5.00%)]. Statistically, a significant difference was observed among groups [p=0.0036*].

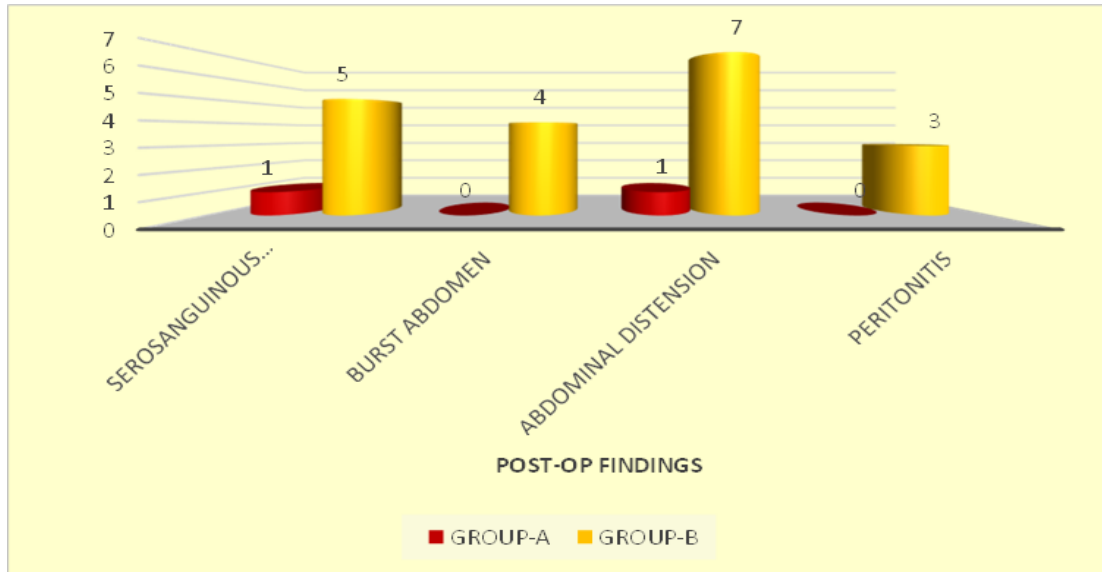


Figure-5: Post-operative findings of enrolled patients:

In group A, Serosanguinous discharge was noted in only 1 patient, while in group B, it was observed in [5(12.50%)] patients. Abdominal distension was also noted in group A in 1 patient only, whereas, in group B, it was observed in [7(17.50%)] patients. Statistically, a significant difference was observed in the burst abdomen [p=0.0402*] and abdominal Distension [p=0.0253*].

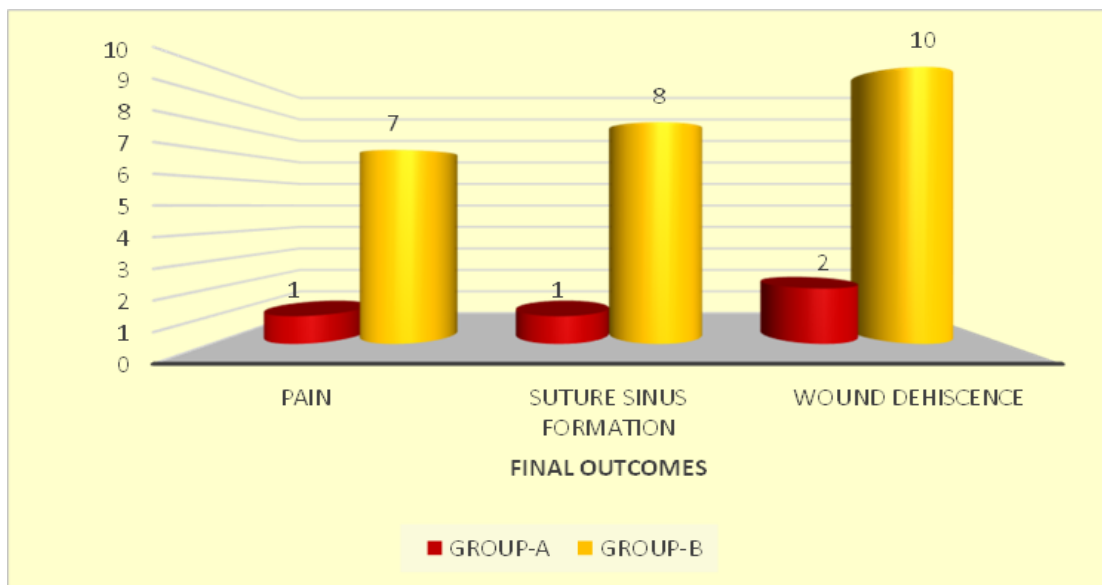


Figure 6: Final outcomes of enrolled patients:

The above figure has also established that in Group A only 2 patients had pain and suture sinus formation. At the same time, in group B, 7 patients had pain, and 8 had suture sinus formation. Statistically, a significant difference was observed among the groups. In this study the above mentioned observations advocated that the group-A, absorbable suture polydioxanone was significantly much better in almost all parameters as compared to group-B, non-absorbable suture polypropylene against midline laparotomy wound closure. More sample size as well as more advanced studies is also required.

Discussion:

In the present study, in group A, the majority of the patients [14(35.00%)] were aged between 31-40 years, followed by 21-30 years [11(27.50%)], 41-50 years [8(20.00%)]. In group B, the majority [16(40.00%)] were also aged between 31-40 years, followed by 21-30 years [10(25.00%)], 41-50 years [8(22.00%)]. Male preponderance was observed in both group A [29(72.50%)] and group B [23(57.50%)]. Similarly, Naz S, et al. observed that most of the patients were aged 36-45 in both groups, and male dominance was also noted. Further, Naz S

et al. reported a higher mean age -33.99 ± 14.86 in the PPL group as compared to the PDS group -31.81 ± 14.378 , and the majority of the patients were male in the PDS group $-168(54.2\%)$ and PPL group $-165(53.2\%)[20]$.

In other study, it was reported that the patients in the PPL group was 52.52 ± 11.72 years, and in the PDS group, it was 51.86 ± 12.39 years and subsequently advocated male dominance in both PDS $-34(60.7\%)$ and PPL group $-28(63.6\%)[21]$.

In the present study, the mean serum amylase level was higher in group B $[38.02\pm 6.59]$ than in group A $[37.78\pm 6.63]$. At the same time, serum lipase was higher in group A $[28.63\pm 5.35]$ than in group B $[28.13\pm 5.25]$. In the present study, the coagulation profile showed that the mean prothrombin time was higher in group A $[12.25\pm 0.89]$ compared to group B $[11.93\pm 0.75]$. The prothrombin concentration and International Normalized Ratio were also higher in group A $[91.53\pm 0.67; 91.41\pm 0.42]$ compared to group B $[0.87\pm 0.07; 0.86\pm 0.05]$. In the present study, the mean RBC was higher in group B $[4.51\pm 0.77]$ than in group A $[4.28\pm 0.89]$. The mean Haemoglobin level was also higher in group A $[11.62\pm 1.68]$ than in group B $[11.57\pm 1.46]$. Also, the mean TLC was noted higher in group A $[8632.3\pm 1129.3]$ than in group B $[8162.7\pm 1276.8]$. Platelet count was strikingly higher in group A $[327.2\pm 110.5]$ than in group B $[232.3\pm 116.7]$. In the present study, the mean total protein was found to be higher in in group B $[72.76\pm 4.27]$ than in group A $[71.63\pm 3.88]$. At the same time, serum albumin was higher in group A $[46.66\pm 2.87]$ than in group B $[45.72\pm 2.98]$. Random blood sugar was also noted higher in group A $[124.63\pm 7.53]$ compared to group B $[122.52\pm 6.37]$.

In the present study, the KFT showed higher levels of calcium, sodium, chloride, potassium and blood urea in group A compared to group B. In contrast, serum creatinine was elevated in group B $[0.86\pm 0.09]$ than in group A $[0.83\pm 0.07]$. In the present study, the LFT showed a higher mean level of Alkaline phosphatase (ALP) higher in group A $[82.93\pm 5.84]$ than in group B $[80.88\pm 6.68]$. Although the total bilirubin level, serum glutamic-oxaloacetic transaminase (SGOT) and serum glutamic-pyruvic transaminase (SGPT) were noted higher in group B compared to group A. All the biochemical findings and other test findings were comparable among both the groups. Statistically, a significant difference was observed in platelet count $[p=0.0004*]$, calcium level $[p=0.0085*]$ and sodium level $[p=0.0042*]$ among groups. In the present study, the X-ray of the erect abdomen showed gas under the diaphragm in $[7(17.50\%)]$ patients of group A and $[5(12.50\%)]$ patients of group B. In the present study, the majority of the patients had no pain in both group A $[36(90.00\%)]$ and group B $[23(57.50\%)]$. In group A, patients only had mild

pain $[4(10.00\%)]$, while in group B, moderate pain was also experienced by patients $[2(5.00\%)]$, and this was statistically significant.

In contrast, Zucker BE, et.al. Advocated that the all patients continued to feel modest wound pain and required analgesics for an extended period of time. In group B, which included 100 patients, the pain was mild in 96% of cases and moderated in 4% of subjects in the immediate post-operative period. None of the patients suffered wound pain in the delayed post-operative period, necessitating a shorter time of analgesic use. In both groups, patients were administered the same class of analgesics. Based on the visual analogue pain scale, group A (PDS) has a high incidence of mild and moderate pain, while group B has a high incidence of severe pain (PPL). Overall, the incidence of pain is greater in group B (PPL) than in group A (PDS)[22], also the similar indications/ reports were documented in a few literature reviews[1].

In a study by Murtaza B .et al. also indicated that PPL was associated with a higher incidence of pain during midline fascial closure and also mentioned that, one PPL suture requires five to seven knots for proper strength, and these knots could be painful as compared to PDS, it didn't assimilate and provoke the painful tissue reaction against the foreign body [24].

Van't Riet M et al. also documented similar findings in their meta-analysis and subsequently reported that a significant difference ($p<0.005$) in the occurrence of wound discomfort following midline abdominal fascial closure which was greater with non-absorbable (PPL) sutures than with slowly absorbable sutures (PDS)[25].

In this study, in group A, Serosanguinous discharge was noted in only 1 patient, while in group B, it was observed in $[5(12.50\%)]$ patients. Abdominal distension was also indicated in group A in 1 patient only, whereas, in group B, it was observed in $[7(17.50\%)]$ patients. Burst abdomen and peritonitis were observed in group B only. Statistically, a significant difference was observed in burst abdomen and abdominal distension. In contrast, Bloemen et al. observed no difference in post-operative findings between PDS and PPL groups [27]. Many other studies were also noted to have no difference in post-op complications [26-28].

Similarly, Albahadili M, et al. observed all 4 cases of burst abdomen in patients whose midline was closed using polypropylene suture material. 76 In the delayed post-operative period, the incidence of suture sinus formation was greater with polypropylene suture material (9/100) than with polydioxanone suture material (2/100). The incidence of burst abdomen (wound dehiscence) was relatively low, only 2 patients in the PDS group and 1 in the PPL group experienced abdominal rupture.

This information was insufficient for drawing any meaningful conclusions. Others have reported no difference between absorbable and non-absorbable suture materials in the incidence of wound dehiscence [29,30]. Some studies have found a greater rate of wound dehiscence while using Polydioxanone for abdominal fascial closure compared to non-absorbable sutures (polypropylene or nylon) [31, 32,34, 35]. In contrast to our study, many other studies also noted the incidence of palpable knots that was greater in the polypropylene suture material (23% out of 100) than the polydioxanone suture material, for which no cases were observed during the delayed post-operative period follow-up of patients.[22].

In the present study, the outcome of patients showed that in group A only 2 patients had pain and suture sinus formation. At the same time, in group B, 7 patients had pain, and 8 had suture sinus formation. Wound dehiscence was noted in [2(5.00%)] patients of group A and [10(25.00%)] patients of group B. Statistically, a significant difference was found in outcomes. Similarly, Muturi et.al, found a greater rate of stitch sinus development when PPL was used for abdominal fascial closure compared to PDS [33]. Agarwal et al. also found an increased incidence of stitch sinus formation after using PPL in their research; however, they compared PPL to Polyglactin for abdominal fascial closure [29]. Chalya P L et.al, observed a greater incidence of surgical site infection with non-absorbable (nylon) sutures than with absorbable (Polyglycolic acid) sutures [32].

Hence, large sample size and more advanced studies with standard micro/ macro environmental conditions are required for accurate conclusion.

Conclusion:

Based on the findings of this study, it has been determined that the continuous mass closure technique employing no.1 Polydioxanone (PDS) suture material is superior to no.1 Polypropylene (PPL) suture material in preventing wound complications such as post-operative wound dehiscence, wound pain, burst abdomen, suture sinus formation, serosanguinous discharge and abdominal distension. However, this study had several drawbacks, such as palpable knots were not noted, if any; the study population was also low. In addition, more clinical trials are required to study the closure technique and its benefits.

References:

1. Pai D, Shenoy R, Chethan K Comparison of non-absorbable (polypropylene) versus delayed absorbable (polydioxanone) suture material for abdominal wound closure after laparotomy. *Int Surg J.* 2018; 5(5):1690-1696

2. Heger P, Pianka F, and Diener MK, et al. Current standards of abdominal wall closure techniques: conventional suture techniques. *Chirurg.* 2016; 87:737–43.
3. Brown SR, and Goodfellow PB: Transverse versus midline incisions for abdominal surgery. *Cochrane Database Syst Res.* 2005, 4: CD005199.
4. Förstemann et al. Forces and deformation of the abdominal wall. A mechanical and geometrical approach to the linea alba. *J Biomech.* 2011, 44 (4): 600-606.
5. Halm JA, Lip H, Schmitz PL, and Jeekel J: Incisional hernia after upper abdominal surgery: a randomized controlled trial of midline versus transverse incision. *Hernia.* 2009, 13 (3): 275-280.
6. Albertsmeier A, Seiler CM, Fischer L, Baumann P, Hüsing J, and Seidlmayer C, et al. Evaluation of the safety and efficacy of MonoMax suture material for abdominal wall closure after primary midline laparotomy- a controlled prospective multicentre trial: ISSAAC [NCT005725079]. *Langenbecks Arch Surg.* 2012, 397(3): 363-371.
7. Bellón JM: Biological reasons for an incisional hernia. *Recurrent Hernia. Prevention and Treatment.* Edited by: Schumpelick V, Fitzgibbons RJ. 2007, Germany: Springer-Verlag Berlin Heidelberg, 129-133.
8. Jairam AP, Timmermans L, Eker HH, Pierik REGJM, van Klaveren D, and Steyerberg EW, et al. PRIMA Trialist Group. Prevention of incisional hernia with prophylactic on lay and sub lay mesh reinforcement versus primary suture only in midline laparotomies (PRIMA): 2-year follow-up of a multicentre, double-blind, randomised controlled trial. *Lancet.* 2017 Aug 5; 390(10094):567-576.
9. Muysoms FE, Antoniou SA, Bury K, Campanelli G, Conze J, and Cuccurullo D, et al. European Hernia Society. European Hernia Society guidelines on the closure of abdominal wall incisions. *Hernia.* 2015 Feb;19(1):1-24.
10. Barrow E, et al. Current UK practice in emergency laparotomy. *Ann R Coll Surg Engl.* 2013 Nov; 95(8):599-603.
11. G. Anthimidis, M. Gregoriou, T. Stavrakis, K. Vasiliadou, I. and Lyras, K. Ioannidis and G. Basdanis, "New-Fangled Slowly-Absorbable versus Non-Absorbable Sutures for Abdominal Fascial Closure. Have the Goals towards an Advantageous Suture Been Met?," *Surgical Science*, Vol. 4 No. 6, 2013, pp. 298-301.
12. Shankar KH. A comparative study of outcome of the absorbable suture polydioxanone and nonabsorbable suture polypropylene in laparotomy wound closure. *Int J Res Med Sci* 2016; 4:2084-8.

13. Singal R, Kumar M, Kaushik N, Dhar S, and Singh B. A Comparative Study of Polydioxanone and Nylon for Abdominal Wall Closure with Interrupted Figure of Eight in Peritonitis Cases. *J Curr Surg.* 2016;6(3-4):65-72
14. Odiya S, Hedau S, and Raghuvanshi RK, et al. Comparative study between continuous suture and interrupted suture in laparotomy wound repair. *J. Evolution Med. Dent. Sci.* 2017;6(65):4720-4723,
15. Paunovic M. The Impact of Surgeon Experience, Surgical Techniques and Types of Suture Materials on the Occurrence of Dehiscentia after Laparotomy. *Gen Surg.* 2019; 1(1): 1005.
16. Bharti SV and Sharma A. A Prospective Study Comparing Continuous Versus Interrupted Suture Techniques in Midline Abdominal Wound Closure.2020; *JNGMC*, 18(1):63-66.
17. Ghafoor M, Butt MQ, Imtiaz A, Jamil A, Yaseen MS, and Laique T. Comparison between Polydioxanone and Polypropylene Sutures for Incisional Hernia during Midline Incisional Laprotomy Procedure among Pakistani patients. *P J M H S.* Apr – Jun 2020; 14(2): 682-684.
18. Muturi A, Vihar K, Ann P and Philip M. Technique of Midline Abdominal Incision Closure among Surgical Trainees. *Annals of African Surgery.* 2020 ;17: 72-75.
19. Lozada-Hernández EE, et al. Prevention of incisional hernia with a reinforced tension line (RTL) versus primary suture only in midline laparotomies: 3-year follow-up in a randomized clinical trial. *Hernia.* 2022 Apr; 26(2):447-456.
20. Naz S, Memon SA, Jamali MA, Ahmed MR, and Almani T. Polydioxanone versus polypropylene closure for midline abdominal incisions. *Journal of Ayub Medical College Abbottabad.* 2017 Oct 15; 29(4):591-4.
21. Mohan SV, B Kumar, J Swathi, and V. Darshan. "Comparison between delayed- absorbable polydioxanone (PDS) and non-absorbable (Polypropylene) suture material in abdominal wound closure." *IOSR Journal of Dental and Medical Sciences.* 2015 Feb 14;2(8):16-19
22. Albahadili M, Jabbar M and Ammar A. Polydioxanone sutures instead of polypropylene sutures for abdominal closure to prevent wound sinuses.2020 10.13140/RG.2.2.22149.78562.
23. Zucker BE, Simillis C, Tekkis P, and Kontovounisios C. Suture choice to reduce occurrence of surgical site infection, hernia, wound dehiscence and sinus/ fistula: a network meta-analysis. *Ann R Coll Surg Engl* 2019; 101: 150–161
24. Murtaza B, Ali Khan N, Sharif MA, Malik IB, and Mahmood A. Modified midline abdominal wound closure technique in complicated/high risk laparotomies. *J Coll Physicians Surg Pak.* 2010 Jan;20(1):37-41
25. Van't Riet M, Steyerberg EW, Nellensteyn J, Bonjer HJ, and Jeekel J. Meta- analysis of techniques for closure of midline abdominal incisions. *Br J Surg.* Nov 2002;89(11):1350-1356.
26. Deerenberg EB, Harlaar JJ, Steyerberg EW, Lont HE, van Doorn HC, and Heisterkamp J, et al. Small bites versus large bites for closure of abdominal midline incisions (STITCH): a double-blind, multicentre, randomised controlled trial. *Lancet.* 2015; 26(386):1254-1260.
27. Bloemen A, van Dooren P, Huizinga BF, and Hoofwijk AG. Randomized clinical trial comparing polypropylene or polydioxanone for midline abdominal wall closure. *Br J Surg.* 2011 May; 98(5):633-9.
28. Gejoe G, Yadav I, and Rahul M. Emergency Laparotomies at a Tertiary Care Center-a Hospital-Based Cross-Sectional Study. *Indian J Surg.* 2017 Jun; 79(3):206-211.
29. Agrawal V, Sharma N, Joshi M, and Minocha V. Role of suture material and technique of closure in wound outcome following laparotomy for peritonitis. *Tropical Gastroenterol.* 2009; 30(4):237-40.
30. Cocco AM, Bhagvan S, Bouffler C, and Hsu J. Diagnostic laparoscopy in penetrating abdominal trauma. *ANZ J Surg.* 2019 Apr; 89(4):353-356.
31. Sajid M, Parampalli U, and Baig M, McFall M. A systematic review on the effectiveness of slowly absorbable versus non-absorbable sutures for abdominal fascial closure following laparotomy. *Int J Surg.* 2011;9(8):615-25
32. Chalya P L, Massinde A N, Kihunrwa A and Mabula J B. Abdominal fascia closure following elective midline laparotomy: a surgical experience at a tertiary care hospital in Tanzania, *BMC Res Notes*, 2015; 8:281
33. Muturi A, Vihar K, Ann P and Philip M. Technique of Midline Abdominal Incision Closure Among Surgical Trainees, *Ann Afr Surg.* 2020; 17(2):72-75
34. Jha AK, Sinha R N P and Prakash P, Comparative Study of Non-Absorbable Versus Delayed Absorbable Suture Material and Suturing Technique in Midline Abdominal Closure. *Annals of International Medical and Dental Research*, 2019, 5 (5): 11-13
35. Fortelny RH, The Best Closure Technique Without Mesh in Elective Midline Laparotomy Closure. *J. Abdom. Wall Surg.* 2022, 1: 1-7(10962)