“COMPARISON OF NON ABSORBABLE POLYPROPYLENE AND ABSORBABLE POLYDIOXANONE SUTURE FOR UMBILICAL PORT SITE CLOSURE - A RANDOMISED CONTROLLED TRIAL.”

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With reference to the above, we wish to inform you that your proposed research project titled **"COMPARISON OF NON ABSORBABLE POLYPROPYLENE AND ABSORBABLE POLYDIOXANONE SUTURE FOR UMBILICAL PORT SITE CLOSURE- A RANDOMISED CONTROLLED TRIAL",** is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee.

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LIST OF ABBREVIATIONS

Abbreviation	Full Form
SSI	Surgical Site Infection
PDS	Polydioxanone
POD	Post Operative Day
RCT	Randomised Control Trials
VAS	Visual Analog Scale
ERAS	Enhanced Recovery After Surgery
IHEC	Institutional Human Ethics Committee
OR	Odds Ratio
IH	Incisional Hernia
HB	Hemoglobin

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ABSTRACT

Introduction:

Laparoscopic surgery has revolutionized modern medicine, offering patients reduced postoperative pain, shorter hospital stays, and faster recovery compared to traditional open procedures. The umbilical port, typically the largest (10–12 mm) and most frequently used site for camera access, presents unique challenges. Due to its anatomical location and the thickness of the underlying fascia, improper closure can lead to complications such as surgical site infections (SSIs), hematomas, seromas, or port site herniation. These complications not only prolong recovery but also increase healthcare costs and patient morbidity. Despite advancements in surgical techniques, the optimal method for umbilical port closure remains debated, particularly regarding the choice of suture material.

The umbilical port's unique vulnerability to complications—owing to its size, location, and the dynamic stresses exerted by abdominal movement—makes it an ideal focus for investigating suture material efficacy. A suture material's physical properties—such as stiffness, knot profile, or interaction with adjacent tissues—may influence these outcomes, yet this relationship remains poorly characterized. With this background, the study was done with the objectives of comparing post operative port site complications (pain and surgical site infections), after closure of 10mm umbilical port site with non-absorbable polypropylene and absorbable polydioxanone suture in patients undergoing elective laparoscopic surgeries.

Methodology:

This Randomised Control Trial was done at KLES Hospital, Belagavi for 1 year from September 2023 to August 2024 after getting IHEC approval from 78 patients that were distributed among two groups as one group (group A) used closure

of umbilical port site with absorbable 1 number Polydioxanone (PDS) and the other group (group B) used closure of umbilical port site with non-absorbable monofilament 1 number Polypropylene (Prolene) Sutures.

Results:

The study cohort included a total of 78 participants, with a slight predominance of females 43 (55.1%) over males 35 (44.9%). At 12 hours post-surgery, the mean VAS score for the PDS group was recorded as 5.97 ± 1.11, notably lower than the 7.82 ± 0.79 observed in the Prolene group ($p < 0.001$). This difference persisted at 24, 48 hours and also at 3 months postoperatively, with the PDS group consistently experiencing lower pain levels compared to the Prolene group, However it was, at the 3-month follow-up, pain levels had declined in both groups, and the difference was statistically significant ($p = 0.001$). Surgical site infections (SSI) were evaluated using the Southampton scoring system on postoperative day (POD) 3 and 10. On POD 3, 23 (58.9%) patients of PDS group patients had a score of 0 (indicating no infection), compared to 21(53.9%) patients in the Prolene group. A minor proportion of patients developed mild to moderate SSIs (Grades I and II) in both groups. By POD 10, a larger number of participants demonstrated complete wound healing, with 31 patients in the PDS group and 29 in the Prolene group scoring 0 on the Southampton scale.

Conclusion

The study findings suggest that polydioxanone (PDS) sutures may be a preferable choice over polypropylene (Prolene) for umbilical port site closure, primarily due to their association with significantly reduced postoperative pain. While operative times exhibited a marginal decrease in the PDS group, this was not statistically significant.

Keywords: Laparoscopy, Post-operative, Pain, SSI, PDS, Prolene, Knot

INTRODUCTION

Laparoscopic Surgery:

Laparoscopic surgery has revolutionized modern medicine, offering patients reduced postoperative pain, shorter hospital stays, and faster recovery compared to traditional open procedures [1]. Since its inception in the late 20th century, minimally invasive techniques have become the gold standard for a wide range of gastrointestinal surgeries, including cholecystectomy, appendectomy, and colorectal resections. Central to these procedures is the use of trocars—hollow instruments inserted through small incisions (port sites) to facilitate the passage of surgical tools and cameras. While these ports are indispensable, their closure at the conclusion of surgery remains a critical yet often understudied aspect of patient care [2].

The umbilical port, typically the largest (10–12 mm) and most frequently used site for camera access, presents unique challenges [3]. Due to its anatomical location and the thickness of the underlying fascia, improper closure can lead to complications such as surgical site infections (SSIs), hematomas, seromas, or port site herniation. These complications not only prolong recovery but also increase healthcare costs and patient morbidity. Despite advancements in surgical techniques, the optimal method for umbilical port closure remains debated, particularly regarding the choice of suture material [4].

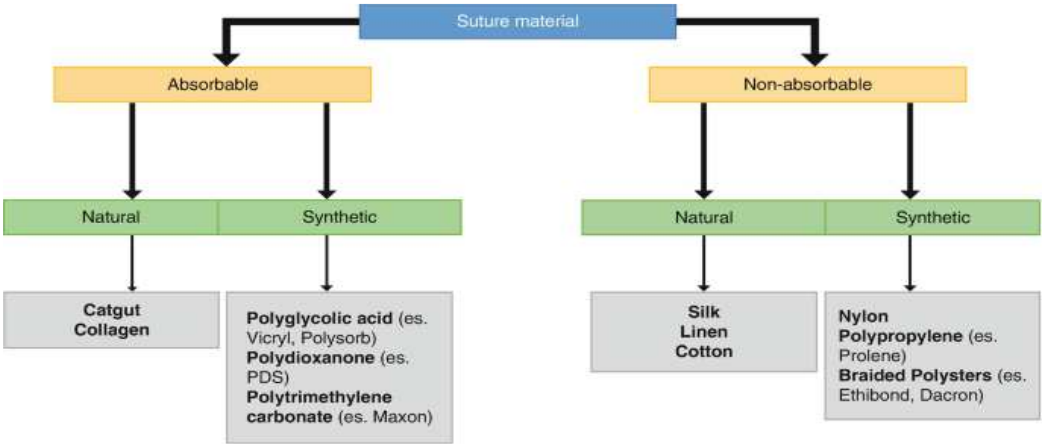
Suture Materials in Port Site Closure:

The selection of suture material for fascial closure is an important decision influenced by factors such as tensile strength, absorption rate, and tissue reactivity. Non-absorbable sutures, such as polypropylene, provide durable support and are often favored for their resistance to degradation, making them a traditional choice for high-

tension closures. However, their permanent presence can incite chronic inflammation or sinus tract formation, potentially leading to discomfort or infection [5].

Conversely, absorbable sutures, such as polydioxanone (PDS), are designed to degrade over time, minimizing long-term foreign body reactions. While this property aligns with the goal of reducing infection risks, critics argue that their gradual absorption may compromise wound integrity during the critical healing phase, particularly in patients with comorbidities such as obesity or diabetes [6].

Figure 1: Classification of suture materials.



Courtesy: Maruccia et al. [6]

Rationale for the Study:

The umbilical port's unique vulnerability to complications—owing to its size, location, and the dynamic stresses exerted by abdominal movement—makes it an ideal focus for investigating suture material efficacy. Gastrointestinal surgeries, in particular, present additional risks due to potential exposure to bowel contents and microbial flora, heightening the stakes for optimal wound closure. Despite this, few randomized controlled trials (RCTs) have directly compared absorbable and non-

absorbable sutures in this context, leaving surgeons to rely on institutional preferences or anecdotal experience [7].

Furthermore, patient-reported outcomes, such as postoperative pain and satisfaction, are frequently overlooked in existing studies. Chronic pain at the umbilical site, though less common than infections or herniation, can significantly impair quality of life and functional recovery. A suture material's physical properties—such as stiffness, knot profile, or interaction with adjacent tissues—may influence these outcomes, yet this relationship remains poorly characterized [8].

Significance of the Study:

This trial holds immediate clinical relevance. Surgical site infections affect approximately 2–5% of laparoscopic patients, with higher rates observed in gastrointestinal procedures due to contamination risks. Reducing these complications aligns with global healthcare initiatives to improve surgical safety and curb antibiotic resistance. Additionally, herniation at the umbilical site, though less common (1–3%), often necessitates reoperation, imposing physical, emotional, and financial burdens on patients [9].

By elucidating the comparative efficacy of two widely used sutures, this study will help surgeons to make informed, patient-specific choices. Moreover, this research contributes to the broader discourse on value-based surgical care. In an era of rising healthcare costs, optimizing closure techniques to minimize complications directly reduces readmissions, reinterventions, and resource utilization. Patient-centered outcomes further ensure that clinical practices align with individuals' priorities, fostering trust and adherence to postoperative care protocols.

Need of the Study:

Prior studies on port site closure have been limited by retrospective designs, small sample sizes, or heterogeneous patient populations [9, 10, 11]. This present study addresses these shortcomings through prospective randomization, and standardized surgical protocols to minimize bias. By focusing exclusively on elective gastrointestinal surgeries—a population with uniform contamination risks and healing challenges—the results will offer precise, generalizable recommendations for this surgical subset. Importantly, this study also incorporates a longitudinal follow-up period. (3 months) to capture delayed complications such as suture sinus formation or chronic Pain, which are often missed in shorter trials.

The closure of the umbilical port site, though a seemingly minor step in laparoscopic surgery, carries profound implications for patient outcomes. As the demand for minimally invasive techniques grows, refining these techniques becomes imperative to uphold the safety and efficacy that define modern surgery. This randomized controlled trial represents a critical step toward resolving the enduring debate over selection of suture materials.

OBJECTIVES

Aim

To compare the results of post-operative port site complications (Pain and Surgical site infections), after closure of 10mm umbilical Port site with non-absorbable polypropylene and absorbable polydioxanone suture in patients undergoing elective Laparoscopic Surgeries

Objectives

- **Primary**

To compare the following outcomes of closure of umbilical Port site with non-absorbable polypropylene and absorbable polydioxanone suture

- Pain
- Surgical site Infection

- **Secondary**

To compare the following outcomes of closure of umbilical Port site with non-absorbable polypropylene and absorbable polydioxanone suture

- Palpable knot
- Port Site Hernias.

REVIEW OF LITERATURE

The anterior abdominal wall is composed of four primary muscle layers that are traversed during trocar placement in laparoscopic procedures. These muscles include the rectus abdominis, external oblique, internal oblique, and transversus abdominis. Regardless of the specific entry site chosen, these muscle layers are invariably involved in laparoscopic access. Although the exact points of penetration may differ based on the surgical approach, the standard placement of trocars follows relatively uniform insertion zones [12].

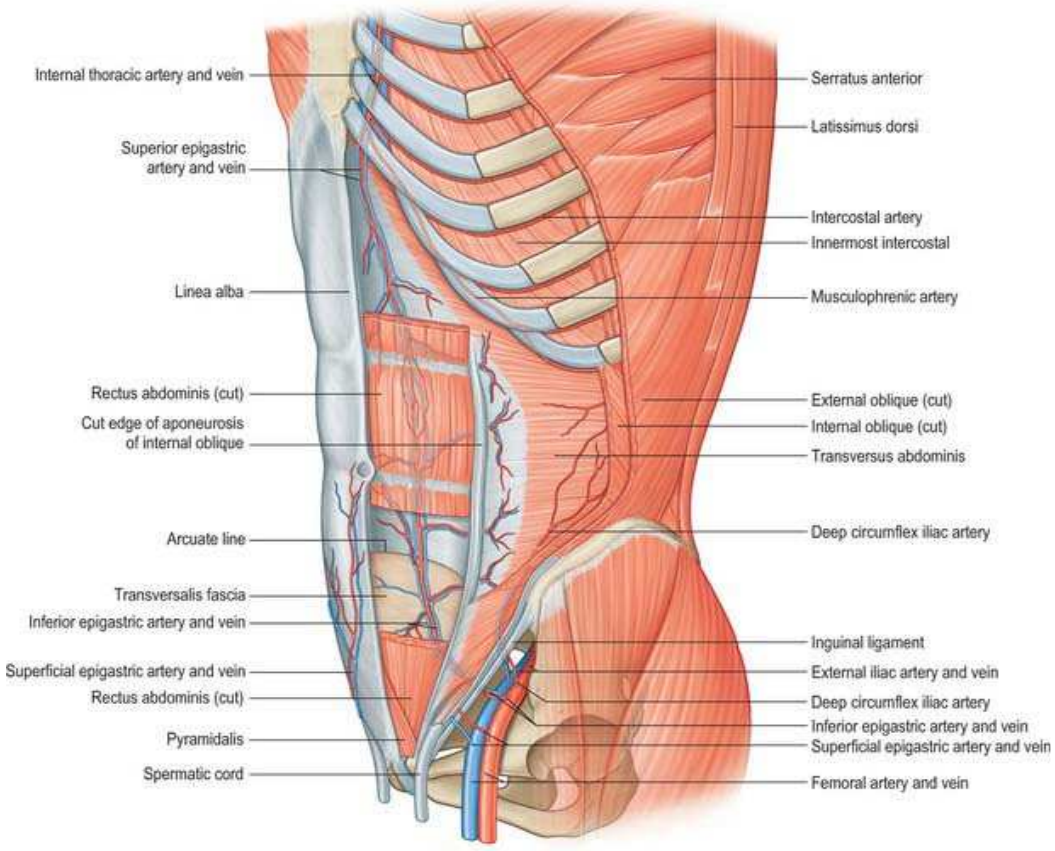
Blood Supply

In the subumbilical region, no major vascular structures pose a significant risk during trocar insertion. However, strict adherence to the midline is essential to prevent inadvertent damage to the paramedian vasculature. Two key arteries within the superficial abdominal wall warrant attention—the superficial epigastric artery and the superficial circumflex iliac artery. Even minor lacerations to these vessels can result in considerable bleeding, potentially necessitating conversion from laparoscopy to open surgery [13].

The superficial epigastric artery originates from the femoral artery, emerging approximately 1 cm below the inguinal ligament. It courses superiorly, extending between the layers of the superficial fascia and reaching near the umbilicus. Similarly, the superficial circumflex iliac artery arises from the femoral artery in close proximity to the superficial epigastric artery. After penetrating the fascia lata, it follows a lateral trajectory parallel to the inguinal ligament before branching toward the iliac crest [13].

These vessels can often be visualized preoperatively using diaphanoscopy, a technique that allows transillumination of superficial structures to identify and avoid vascular injury during trocar insertion.

Figure 2: Anatomy of abdominal wall.



Optimal Sites for Trocar Placement

The supra-umbilical region is the preferred site for inserting the laparoscope and optical trocar, typically through a semilunar or straight incision. If umbilical access is not feasible—due to factors such as extensive adhesions or the presence of large intra-abdominal masses—alternative entry sites, such as supraumbilical access or Palmer's point, may be considered [14].

The positioning of working trocars is dictated by the surgical target. To optimize surgical maneuverability, the optic trocar should be maximally spaced from the working trocars, and their arrangement should avoid strict cranio-caudal alignment by staggering their positions slightly [15].

Apart from structures like the obliterated urachus and the bladder in the lower abdomen, no critical anatomical features impede trocar placement in these areas.

Key Anatomical Landmarks of the Abdominal Wall

Recognizing anatomical landmarks is crucial for safe trocar insertion [16].

- Median Umbilical Fold (Plica Umbilicalis Mediana) : Positioned along the midline, this fold contains the obliterated urachus, a fetal remnant that requires no particular surgical concern unless the bladder is distended (e.g., post-cesarean section).
- Medial Umbilical Fold (Plica Umbilicalis Medialis) : Located lateral to the median fold, this structure houses the obliterated umbilical artery, which once transported fetal blood to the placenta but becomes functionally insignificant after birth.
- Lateral Umbilical Fold (Plica Umbilicalis Lateralis): This fold contains the inferior epigastric vessels, which arise from the external iliac artery near the inguinal ligament. The inferior epigastric artery ascends obliquely through the subperitoneal space, penetrating the transversus abdominis fascia before coursing between the rectus abdominis muscle and its posterior sheath. Superior to the umbilicus, it branches extensively and anastomoses with the superior epigastric artery. Unlike superficially located vessels, the inferior

epigastric artery is not easily visualized via diaphanoscopy, necessitating careful palpation for safe trocar insertion.

Entry Techniques and Port Placement

The approach to entering the abdominal cavity in laparoscopic procedures can be categorized into three distinct techniques [20, 21]:

- Open Technique (Hasson Method)
- Classical Closed Technique (Veress Needle Entry)
- Modified Closed Technique (Direct Trocar Insertion)

While gynecologists predominantly employ the classical closed-entry method, general surgeons often favor the open approach. The modified closed technique is less commonly used.

Regardless of surgical proficiency, the crucial steps in laparoscopy include establishing a pneumoperitoneum and inserting the primary trocar. This can be achieved via the Veress needle technique (blindly or under direct vision) or through the Hasson method (minilaparotomy).

Open-Entry Technique (Hasson Method)

Developed by Harrith Hasson in 1974, the open-entry technique remains widely practiced. It involves making a subumbilical minilaparotomy before CO_2 insufflation, allowing direct visualization of the trocar insertion. While considered safer in terms of vascular injury, this method has increased risk of air leaks, wound infections, and longer incision healing times. Studies, including randomized trials and Cochrane reviews, have found no definitive safety advantage over the closed technique [19].

Closed-Entry Technique (Veress Needle and CO2 Insufflation)

For Veress needle insertion, the patient is positioned horizontally, with Trendelenburg tilt applied The needle is typically inserted at the umbilicus, with incisions ranging from 0.5 cm for a 5 mm optic trocar to 1.5 cm for a 10 mm trocar. Careful palpation of the aorta and iliac bifurcation aids in minimizing vascular injury [20].

Primary Trocar Placement

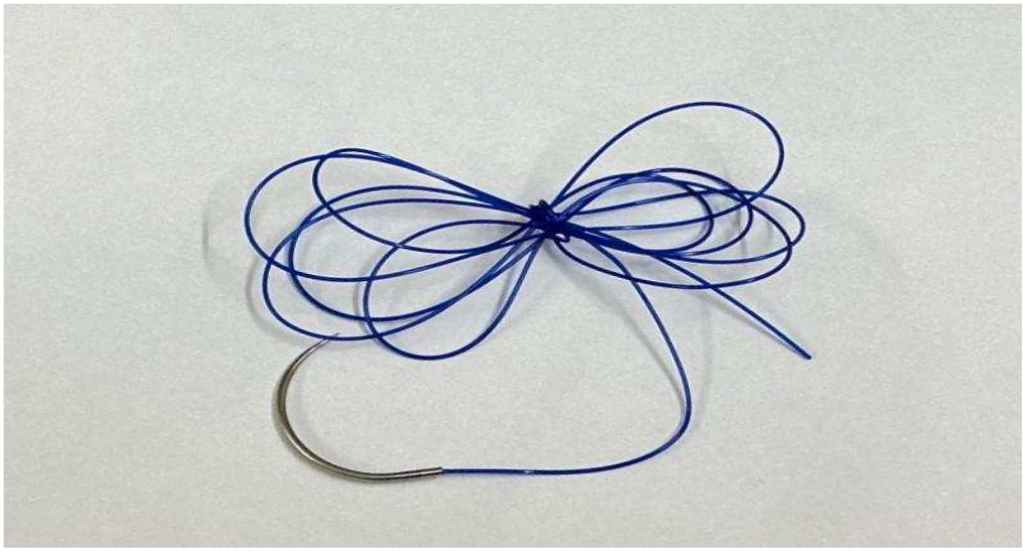
Following pneumoperitoneum establishment, intra-abdominal pressure is raised to 18–25 mmHg to optimize trocar insertion. This pressure is reduced to 12–15 mmHg post-placement for ventilation purposes. Various safety checks, including aspiration and the “hiss phenomenon” (soft hissing sound indicating successful trocar penetration), are performed to ensure proper placement [21].

Visual Entry Technique

Increasingly favored among general surgeons, entry under vision involves using direct vision trocars or optic-guided screw-in port systems. These techniques allow continuous visualization of each tissue layer, reducing the risk of organ injury [22].

PROLENE SUTURE

Figure 3: Polypropylene (Prolene) Sutures



Sutures play a pivotal role in surgical practice, facilitating wound closure, tissue approximation, and hemostasis. Among the numerous suture materials available, polypropylene and polydioxanone sutures are widely utilized, each possessing distinct physical, chemical, and biological characteristics.

Composition and Structure

Polypropylene sutures are composed of a synthetic, thermoplastic polymer derived from propylene. These sutures are non-absorbable, monofilamentous, and demonstrate excellent tensile strength with minimal tissue reactivity [24].

Physical and Mechanical Properties

Monofilament Structure: Polypropylene sutures consist of a single strand, reducing capillarity and minimizing the risk of bacterial colonization [25].

High Tensile Strength: These sutures exhibit superior tensile strength, ensuring durable wound support.

Minimal Tissue Drag: The smooth surface of polypropylene sutures allows for easy passage through tissues, reducing friction and trauma.

Knot Security: While these sutures are less prone to breakage, their monofilament nature results in lower knot-holding capacity, necessitating secure knotting techniques.

Biocompatibility and Tissue Reaction

Polypropylene is biologically inert and induces minimal tissue reaction. Unlike some non-absorbable materials that provoke foreign body responses, polypropylene is associated with a lower incidence of chronic inflammation or granuloma formation [26].

Indications and Clinical Applications

Polypropylene sutures are widely employed in various surgical specialties, including [27]:

General Surgery: Skin closure, hernia repairs, and bowel anastomoses.

Cardiovascular Surgery: Vascular anastomoses due to its stability and biocompatibility.

Ophthalmic Surgery: Corneal and scleral suturing.

Plastic and Reconstructive Surgery: Facial and aesthetic procedures where minimal scarring is desired.

Advantages

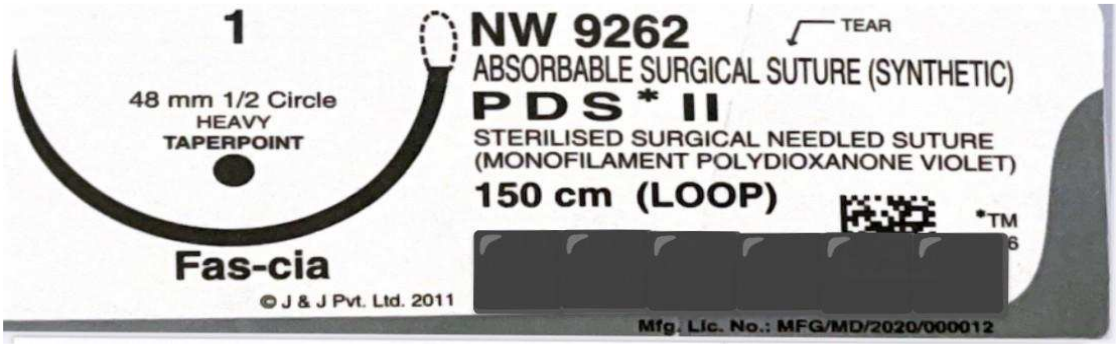
- Resistant to degradation and enzymatic breakdown.
- Minimal tissue reactivity, reducing inflammatory response.
- Excellent strength retention over time.
- Low risk of bacterial colonization due to monofilament nature.

Limitations

- Requires multiple knots for secure closure.
- Less pliable compared to some absorbable alternatives.
- Difficult to handle for some surgeons due to its smooth, slippery texture.

PDS SUTURE

Figure 4: Polydioxanone (PDS) Sutures



Composition and Structure

Polydioxanone (PDS) sutures are synthetic, absorbable monofilament sutures composed of polymerized para-dioxanone. These sutures are designed to maintain tensile strength for an extended period before undergoing hydrolytic degradation [28].

Physical and Mechanical Properties

Monofilament Construction: Like polypropylene, polydioxanone sutures are monofilament, reducing capillarity and bacterial adherence.

High Initial Tensile Strength: PDS sutures retain substantial strength for up to six weeks postoperatively before gradual degradation [29].

Long Absorption Time: Complete absorption occurs through hydrolysis within 180-210 days, making it ideal for applications requiring prolonged support.

Knot Security: Compared to other absorbable sutures, polydioxanone provides moderate knot security, though multiple knots are recommended.

Biocompatibility and Tissue Reaction

Polydioxanone sutures elicit a minimal inflammatory response, as their degradation occurs via hydrolysis rather than enzymatic breakdown. The slow absorption process ensures that tensile strength persists during critical phases of wound healing, reducing the likelihood of wound dehiscence [30].

Indications and Clinical Applications

Polydioxanone sutures are frequently used in:

General Surgery: Internal soft tissue approximation where extended support is needed.

Pediatric Surgery: Useful in neonates and infants due to prolonged absorption and minimal foreign body reaction.

Gastrointestinal Surgery: Closure of enterotomies, bowel anastomoses, and peritoneal repairs [31].

Orthopedic Surgery: Tendon and ligament repair, where strength retention is crucial.

Gynecologic and Obstetric Surgery: Uterine and vaginal closures, especially in cesarean deliveries.

Advantages

- Prolonged tensile strength retention supports healing in high-tension areas.
- Predictable hydrolytic absorption with minimal tissue inflammation.
- Monofilament structure reduces infection risk.
- Flexible and easy to handle.

Limitations

- Absorbable nature limits long-term structural support.
- More expensive compared to some other synthetic absorbable sutures.
- Knot security is lower than that of non-absorbable alternatives, necessitating careful tying techniques.

Table 1:Comparison: Polypropylene vs. Polydioxanone Sutures.

Characteristics	**Polypropylene Sutures (Prolene)**	**Polydioxanone Sutures (PDS)**
Composition	Synthetic polyolefin	Polymerized para-dioxanone
Absorbability	Non-absorbable	Absorbable via hydrolysis (180-210 days)
Structure	Monofilament	Monofilament
Tensile Strength	Excellent, does not degrade	High, degrades gradually
Tissue Reaction	Minimal	Minimal
Knot Security	Moderate, requires secure knots	Moderate, multiple knots recommended
Common Uses	Skin closure, vascular surgery, hernia repair	Gastrointestinal, pediatric, and orthopedic procedures
Infection Risk	Low	Low
Handling	Stiffer, slightly difficult to knot	More flexible, easier to handle

The selection of a suture material depends on several factors, including the type of tissue, required tensile strength, duration of wound support, and risk of infection. Polypropylene is preferred in scenarios requiring indefinite tensile strength, such as vascular and hernia repairs. Polydioxanone is ideal for internal soft tissue closures where long-term but temporary support is necessary. Both materials offer excellent biocompatibility, but polydioxanone is advantageous in pediatric and high-risk infection cases.

Both polypropylene and polydioxanone sutures have distinct advantages that make them invaluable in various surgical procedures. Polypropylene sutures offer durable, non-absorbable support, while polydioxanone sutures provide long-term yet absorbable wound reinforcement. The choice between these materials should be guided by the surgical indication, tissue type, and desired healing outcomes.

Findings from relevant Literature

In a prospective randomized clinical trial conducted by Bloemen et al., the efficacy of non-absorbable polypropylene (Prolene®) and absorbable polydioxanone (PDS®) sutures for midline abdominal wall closure was compared, focusing on the incidence of incisional hernia, surgical-site infection, and suture sinus formation. A total of 456 patients were randomized, with 223 undergoing fascial closure with polypropylene and 233 with polydioxanone. The median follow-up period was 32 months for the polypropylene group and 31 months for the polydioxanone group. The incidence of incisional hernia did not significantly differ between the two groups, occurring in 20.2% (45/223) of patients in the polypropylene cohort and 24.9% (58/233) in the polydioxanone cohort (P = 0.229). Kaplan-Meier survival analysis demonstrated cumulative incisional hernia rates of 23.7% for polypropylene and 30.2% for polydioxanone at four years (P = 0.222). Secondary outcomes, including surgical-site infection and suture sinus formation, also showed no statistically significant differences. The study concluded that the incidence of incisional hernia was higher than previously reported in the literature, and no significant superiority was observed between the two suture materials in midline abdominal wall closure [32].

In a comparative clinical study by Tyagi and Raza, the effectiveness of Prolene, PDS II, and PDS Plus sutures for midline abdominal wound closure was evaluated concerning post-operative complications. With approximately 700,000 open abdominal procedures performed annually in Germany and 4 million in the United States, the global incidence of abdominal surgery is estimated at 25 per 10,000 individuals. Incisional hernia remains a major postoperative complication, with a stable incidence of 5% to 24% over the decades. This study aimed to determine the

optimal suture material that minimizes postoperative wound complications such as infection, dehiscence, sinus formation, incisional hernia, and pain. Patients undergoing elective and emergency abdominal surgeries were assessed postoperatively, with wound evaluation on the fifth day, stitch removal on the ninth day, and follow-up at one, two, and six months. The results indicated that Prolene, PDS II, and PDS Plus were equally effective for midline laparotomy closure using a continuous running technique. However, infection rates were significantly lower with PDS Plus (3.3%) compared to PDS II (26.7%), likely due to the antiseptic properties of PDS Plus. Despite its superior infection control, PDS Plus was not deemed cost-effective, necessitating further research to assess its availability, cost-effectiveness, and impact on health-related quality of life [33].

	PDS II	PDS PLUS
WOUND INFECTION	26.7%	3.3%
COST	RELATIVELY INEXPENSIVE	EXPENSIVE

In a randomized controlled trial by Cameron et al., 284 patients undergoing laparotomy through a vertical incision were assigned to abdominal wall closure using either polydioxanone (PDS®) or polypropylene (Prolene®) sutures with interrupted mass closure technique. The study evaluated post-operative complications, including dehiscence, infection, incisional hernia, knot palpability, and wound pain. Dehiscence was significantly lower in the PDS group (0.7%) compared to the Prolene group (6.4%) (P=0.018). Wound infection rates were 8.6% for PDS and 15.4% for Prolene, though this difference was not statistically significant (P=0.1). Of the 190 patients who attended follow-up after a minimum of one year, the incidence of incisional

hernia was equal in both groups (11%). However, the presence of palpable knots was markedly lower in the PDS group (2%) compared to the Prolene group (12%). Additionally, postoperative wound pain was less frequent in the PDS group (12%) than in the Prolene group (23%) (P=0.06). These findings suggest that polydioxanone may offer advantages over polypropylene for abdominal closure, particularly in reducing dehiscence and postoperative discomfort [34].

	PROLENE	PDS
WOUND INFECTION	15.4%	8.6%
WOUND DEHISCENCE	6.4%	0.7%
POST OPERATIVE PAIN	26%	12%
PALPABLE KNOT	12%	2%

In a prospective observational study conducted by Pai et al. at Kasturba Hospital, Manipal, between September 2014 and August 2016, the efficacy of polypropylene (Prolene®) and polydioxanone (PDS®) sutures for abdominal wall closure following elective midline laparotomy was evaluated. The study aimed to identify the superior suture material by comparing postoperative complications. A total of 100 patients were included, with both groups being homogenous concerning age, BMI, comorbidities, and surgical indications. The incidence of surgical site infection was significantly higher in the Prolene group (P=0.031). Additionally, the duration of surgery was prolonged in the Prolene group (P=0.020). To account for this variable, a subgroup analysis of cases with operative times under four hours was conducted, revealing no statistically significant difference in infection rates between the two groups (P=0.320). There were no significant differences in the occurrence of burst abdomen or incisional hernia between the groups. These findings suggest that

polydioxanone may reduce surgical site infection rates in prolonged procedures but does not confer a distinct advantage over polypropylene in terms of incisional hernia or fascial dehiscence [35].

A study conducted by Albahadili et al. assessed the efficacy of polydioxanone (PDS®) versus polypropylene (Prolene®) sutures for abdominal wall closure following Pfannenstiel incisions, with a particular focus on the occurrence of wound sinuses. Over a two-year period, 235 patients were included, with 133 undergoing closure with polypropylene (non-absorbable) and 102 with polydioxanone (slow-absorbable). The findings demonstrated a significantly higher incidence of wound sinus formation in the polypropylene group, while no statistically significant difference was observed in the incidence of incisional hernia between the two suture types. The study concluded that polydioxanone provides comparable tensile strength to polypropylene while potentially reducing the risk of wound sinus formation, making it a viable alternative for abdominal closure [36].

A study by Naz et al. evaluated the effectiveness of polydioxanone (PDS®) versus polypropylene (Prolene®) sutures for midline abdominal closure, focusing on postoperative wound pain and infection. Conducted at the Federal Government Services Hospital, Islamabad, the study included 620 patients, divided equally into two groups: Group A (Polydioxanone) and Group B (Polypropylene). Postoperative wound pain was assessed using the Visual Analog Scale (VAS), categorizing pain as no pain (0), mild (1–3), moderate (4–6), and severe (7–9). In the polydioxanone group, 32.6% reported no pain, 30.6% mild pain, 26.1% moderate pain, and 10.6% severe pain. In contrast, the polypropylene group had 26.5% with no pain, 13.9% mild pain, 19% moderate pain, and a significantly higher 40.6% experiencing severe pain. Additionally, postoperative wound infection was significantly lower in the

polydioxanone group (33.9%) compared to the polypropylene group (67.1%). The study concluded that polydioxanone results in reduced wound pain and lower infection rates compared to polypropylene, making it a preferable choice for midline abdominal closure [37].

	PDS	PROLENE
POST OPERATIVE PAIN		
NO PAIN	32.6	26.5%
MILD	30.6%	13.9%
MODERATE	26.1%	19%
SEVERE	10.6%	40.6%

	PDS	PROLENE
SURGICAL SITE INFECTION	33.9%	67.1%

	SSI	POST OPERATIVE PAIN
PDS	+	+
PROLENE	+++	+++

A study by Shankar et al. assessed the clinical equivalence of PD Synth (Healthium Medtech Limited) and PDS (Ethicon, Johnson & Johnson) polydioxanone sutures for abdominal fascial closure following midline laparotomy. Conducted as a prospective, multicenter, randomized controlled trial between December 2020 and May 2023, the study included 88 patients undergoing elective or emergency midline laparotomy, randomized into PD Synth (n=45) and PDS (n=43) groups. The primary

outcome measured was the incidence of incisional hernia within six and twelve months post-surgery, while secondary outcomes included fascial dehiscence, surgical site infection (SSI), suture sinus, seroma, hematoma, scar tenderness, re-suturing, hospital stay, intraoperative suture handling, pain, time to resume daily activities, and overall patient satisfaction. Results showed that one patient in each group developed an incisional hernia at the umbilicus within 12 months, with no significant difference between groups ($p>0.05$). The PDS group reported one case of SSI on postoperative day two, another on day seven, and one at one month, along with two cases of seroma on day seven and one readmission at one month. In the PD Synth group, two patients developed superficial SSI at one month. Other secondary endpoints were comparable between the groups. The study concluded that both PD Synth and PDS are clinically equivalent for abdominal fascial closure after midline laparotomy, supporting their interchangeable use in surgical practice [38].

A systematic review by Sajid et al. evaluated the effectiveness of delayed-absorbable (polydioxanone, PDS) versus non-absorbable (polypropylene, Prolene, and nylon) sutures for abdominal fascial closure following laparotomy. The analysis included eight randomized trials with a total of 4,261 patients. The findings indicated no statistically significant differences between PDS and non-absorbable sutures in key post-operative outcomes. The risk of incisional hernia was similar between groups (OR 1.10; 95% CI 0.87–1.37; $p=0.43$), as was the risk of wound dehiscence (OR 1.04; 95% CI 0.67–1.62; $p=0.85$). Perioperative complications (OR 0.94; 95% CI 0.66–1.33; $p=0.71$) and surgical site infections (OR 0.98; 95% CI 0.68–1.39; $p=0.89$) were also comparable. A trend toward reduced suture sinus formation was observed with PDS (OR 0.58; 95% CI 0.33–1.04; $p=0.07$), though this did not reach statistical significance. Subgroup analysis separately comparing Prolene and Nylon with PDS

yielded similar outcomes. This review suggests that slowly absorbable PDS and non-absorbable Prolene/Nylon sutures demonstrate comparable efficacy for abdominal fascial closure, with no significant differences in major post-operative complications [39].

Zucker et al. conducted a network meta-analysis to evaluate the impact of different suture materials on post-operative complications, including surgical site infection (SSI), incisional hernia, wound dehiscence, and sinus/fistula formation after abdominal surgery. A comprehensive literature search was performed in February 2017, analyzing randomized controlled trials (RCTs) from multiple databases, including Cochrane Central Register of Controlled Trials, Medline, EMBASE, and Science Citation Index Expanded. Thirty-one RCTs, encompassing 11,533 patients, were included. The findings revealed that no single suture material reached the predetermined 90% probability threshold to be classified as the "best treatment" for any specific outcome. Pairwise comparisons generally showed no significant differences between suture types regarding SSI, wound dehiscence, and sinus/fistula formation. However, nylon sutures were associated with a lower risk of incisional hernia compared to two commonly used absorbable sutures: polyglycolic acid (OR 1.91; 95% CI 1.01–3.63) and polyglyconate (OR 2.18; 95% CI 1.17–4.07) [40].

A systematic review was conducted by Bosanquet et al. to estimate the mean IH rate following midline laparotomy and to identify variables predicting IH development. Additionally, the study aimed to analyze whether the type of suture used affects IH rates. Following PRISMA guidelines, randomized trials and observational studies involving patients with midline incisions and standard suture closure were included. Data were independently extracted for each arm of studies with two or more groups. A total of 56 studies, representing 83 distinct patient groups

comprising 14,618 patients, were included in the analysis. The prevalence of IHs after midline incision was found to be 12.8%, with a range from 0% to 35.6%, and the weighted mean follow-up period was 23.7 months. The risk of requiring IH repair after midline laparotomy was estimated at 5.2%. Two meta-regression analyses (Models A and B) identified seven factors associated with an increased IH rate: older age (patient-related), surgery for abdominal aortic aneurysm (AAA), surgery for obesity (Model A), use of an upper midline incision (Model B), previous laparotomies, history of prior IHs, and later year of publication. Interestingly, no significant difference was found in IH rates between absorbable and non-absorbable sutures in either regression model [41].

MATERIALS AND METHODS

THIS STUDY WAS DONE AT KLES DR.PRABHAKAR KORE HOSPITAL AND MEDICAL RESEARCH CENTER, BELAGAVI and DR.PRABHAKAR KORE CHARITABLE HOSPITAL ,BELAGAVI

Study Design: RANDOMIZED CONTROLLED TRIAL

Study Period: 1 SEPTEMBER 2023 - 31AUGUST 2024

Sample Size:

$n=(Z\alpha/2+Z\beta)2(p1q1+p2q2) / (p1-p2)2$

From article Dr. Puneet Tyagi, Dr. Mohammed Raza. A comparative clinical study of post- operative wound complications using Prolene, PDS ll and PDS plus.[2]

Prolene = 53.3% = p1

PDS = 26.7% = p2

For α = 10% $Z\alpha = 1.645$

β = 20% $Z\beta = 0.84$

n = 6.175 x 4446.22/707.56

n = 27455.40/707.56

n =38.8 = 39 in each group

n = 39 + 39 = 78

GROUP A - 39

GROUP B - 39

Total sample size 78

Sampling technique: (SNOSE)

SEQUENTIALLY NUMBERED OPAQUE SEALED ENVELOPES

Inclusion Criteria:

All Patients undergoing elective laparoscopic surgeries between the age of 18-60 years and who gave consent, where included in the study

Exclusion Criteria:

- Patients undergoing emergency procedures
- Patients that are immunocompromised
- Pregnancy
- Patients with umbilical hernias
- Patients with previous Laparotomies
- HIV positive patients

ETHICAL CLEARANCE

This Study is approved by JNMC INSTITUTIONAL ETHICS COMMITTEE

STUDY PROTOCOL

- **Data collection procedure:** After admission, a detailed history and clinical examination was be done for all the patients.
- The following investigations was done for all the admitted patients as pre-operative work up:
    - Haemoglobin
    - Total Leukocyte count
    - HIV and HBsAg
    - Total Protein, Serum Albumin, Albumin/Globulin Ratio
    - Fasting Blood Sugar
- Informed consent was taken for all the patients.
- The patients were divided into two groups pre-operatively for port closure (allocated by random sampling - SNOSE), as:

Group A: Closure of umbilical port site with absorbable 1 number POLYDIOXANONE(PDS)

Group B: Closure of umbilical port site with non-absorbable monofilament 1 number POLYPROPYLENE (PROLENE)

PROCEDURE:

- All patients who underwent Laparoscopic Surgery under General Anaesthesia.
- Following the surgery, the 10mm ports were closed using the allotted technique.

Group A-

- With a 10mm telescope, the intra-abdominal side of the 10mm port site is visualized.
- 1 number PDS (Polydioxanone) suture material was passed with the help of suture passer and the needle is pushed at an angle by the side of the umblical port site through the abdominal wall without piercing the skin.
- The suture passer was then removed, leaving the PDS (Polydioxanone) inside.
- PDS (Polydioxanone) suture was held using Maryland Foceps
- The suture Passer was passed through other side of the umblical port site through the abdominal wall without piercing the skin.
- The free end of the PDS (Polydioxanone) suture was caught with suture passer needle.
- The suture passer was retracted along with the suture.
- Knot is tied and the 10mm port site is closed.

Group B-

- Same procedure was followed as in Group A, but using 1 number POLYPROPYLENE (PROLENE^{TM})suture material.

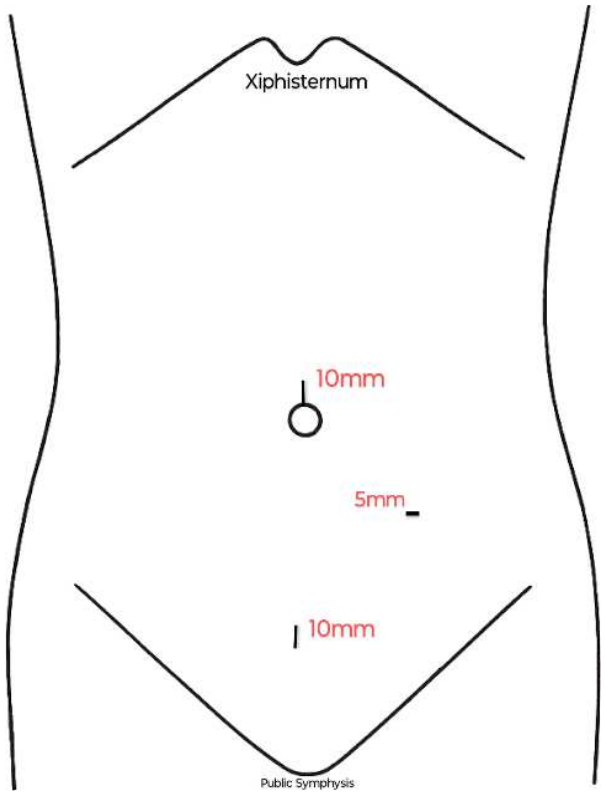
The skin of 10mm, 5mm ports was closed using 2-0 Ethilon in both the groups.

Rescue Analgesia

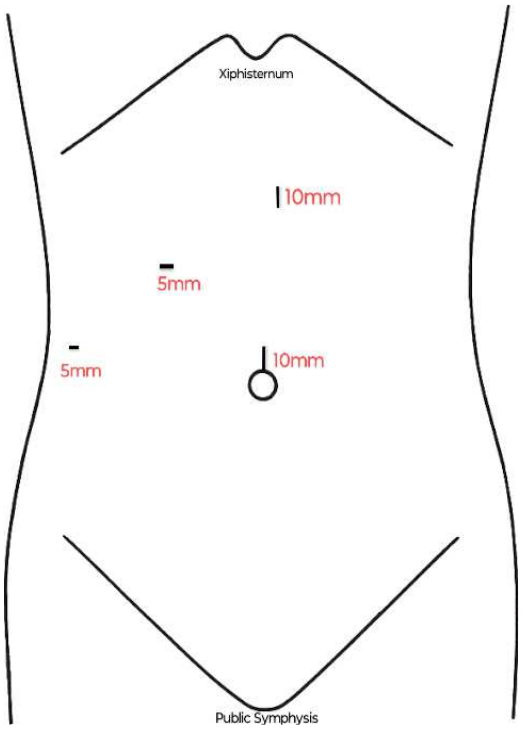
Both the groups were given inj.diclofenac 75mg BD on Pod 0,Pod 1 followed by Tablet Diclofenac 50 mg BD for 5 days

Figure 5: Standardized Port Placement in laparoscopic surgeries

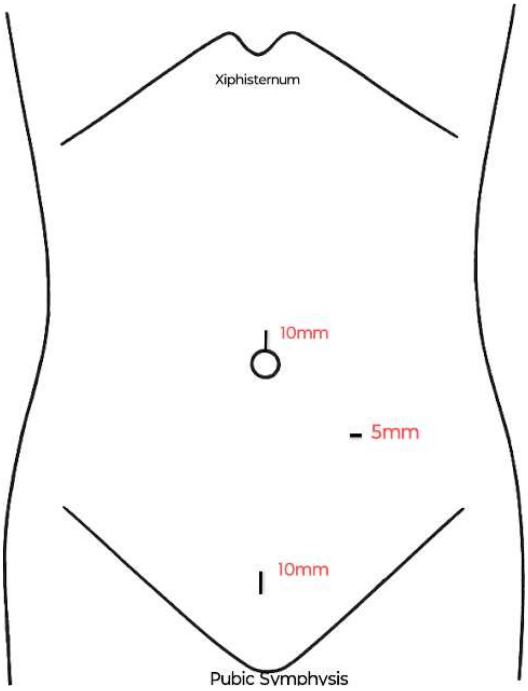
Laparoscopic Appendectomy - Two 10 mm,One 5mm



Laparoscopic cholecystectomy - Two 10mm,Two 5 mm



Diagnostic Laparoscopy - Two 10mm ,One 5 mm



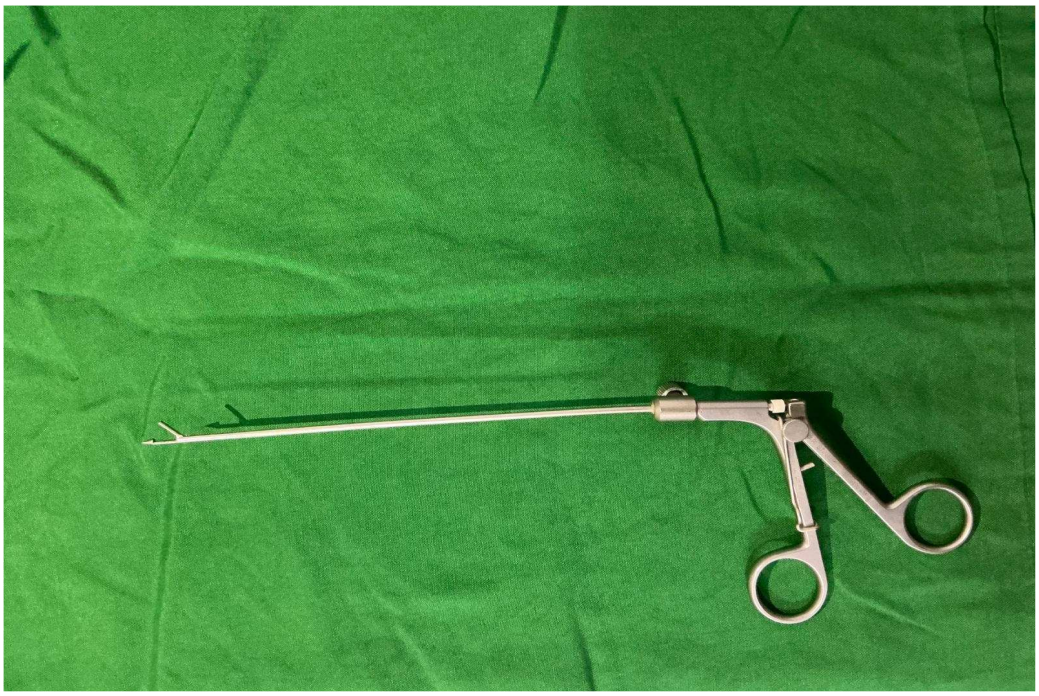


Figure 6: Suture Passer Instrument

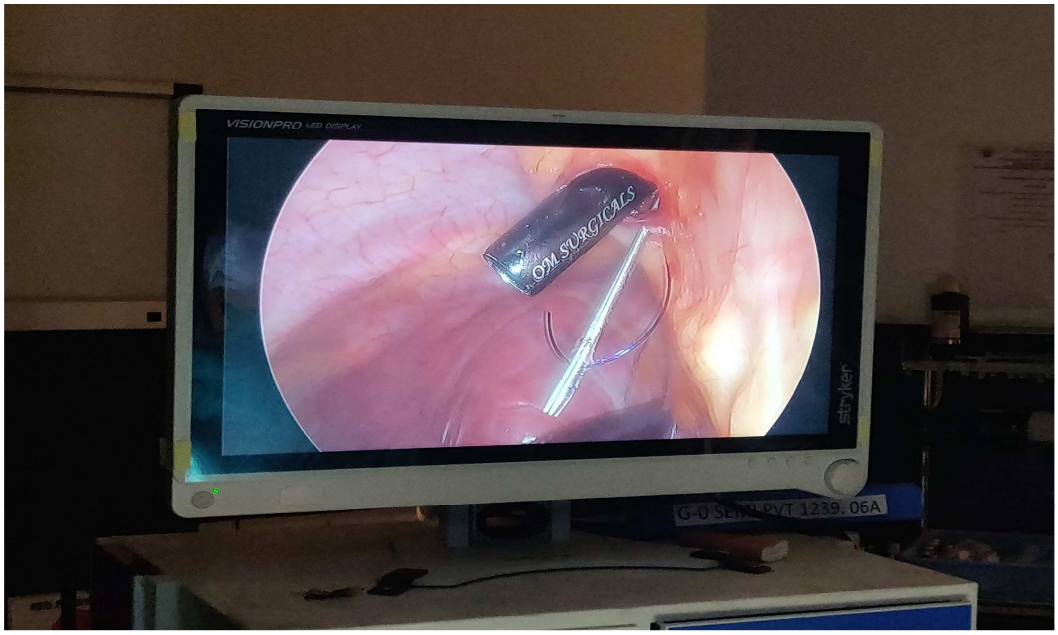


Figure 7: Suture Passer introduced from one side of the Umbilical Port

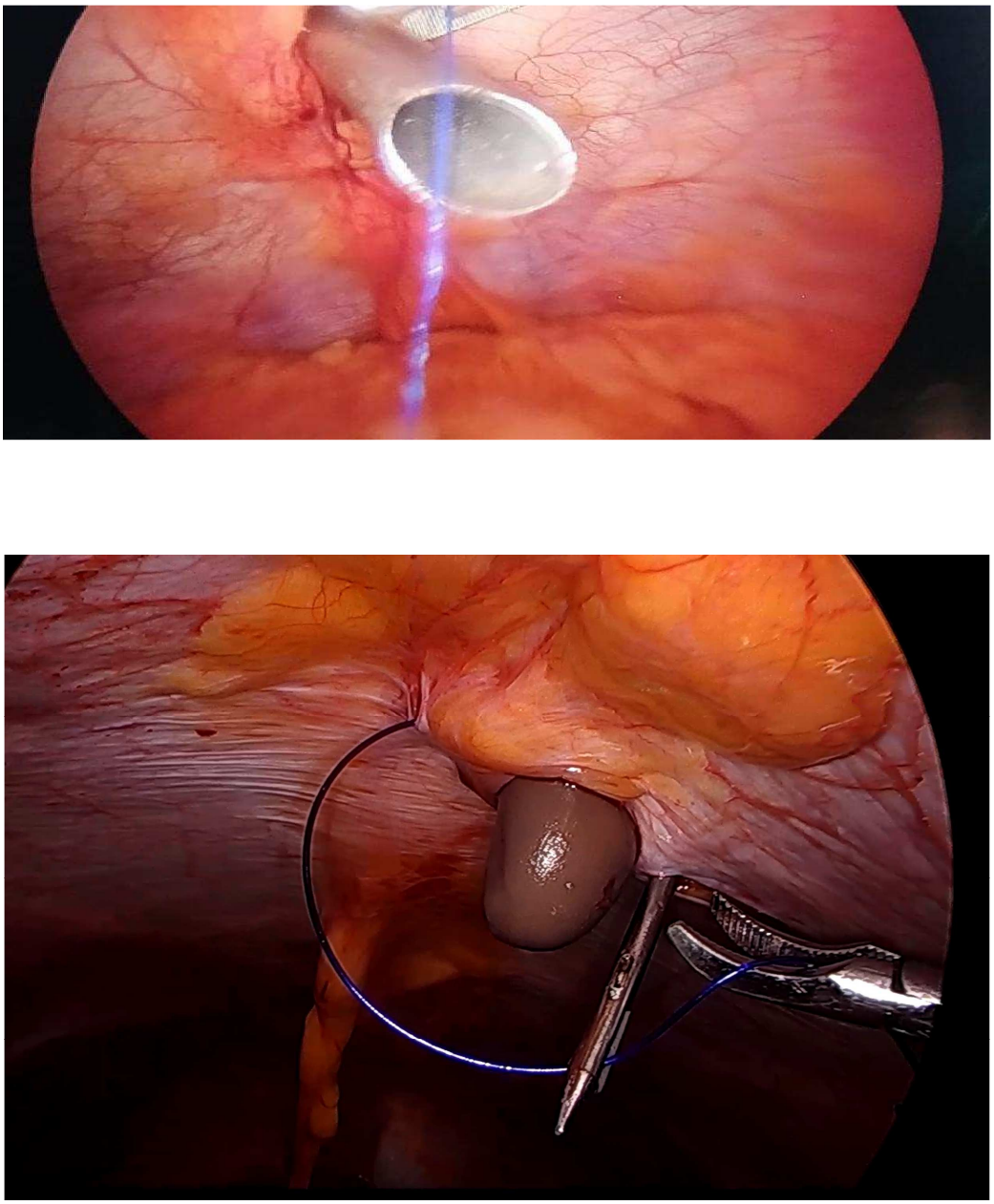


Figure 8: Suture Material caught with Maryland Forceps

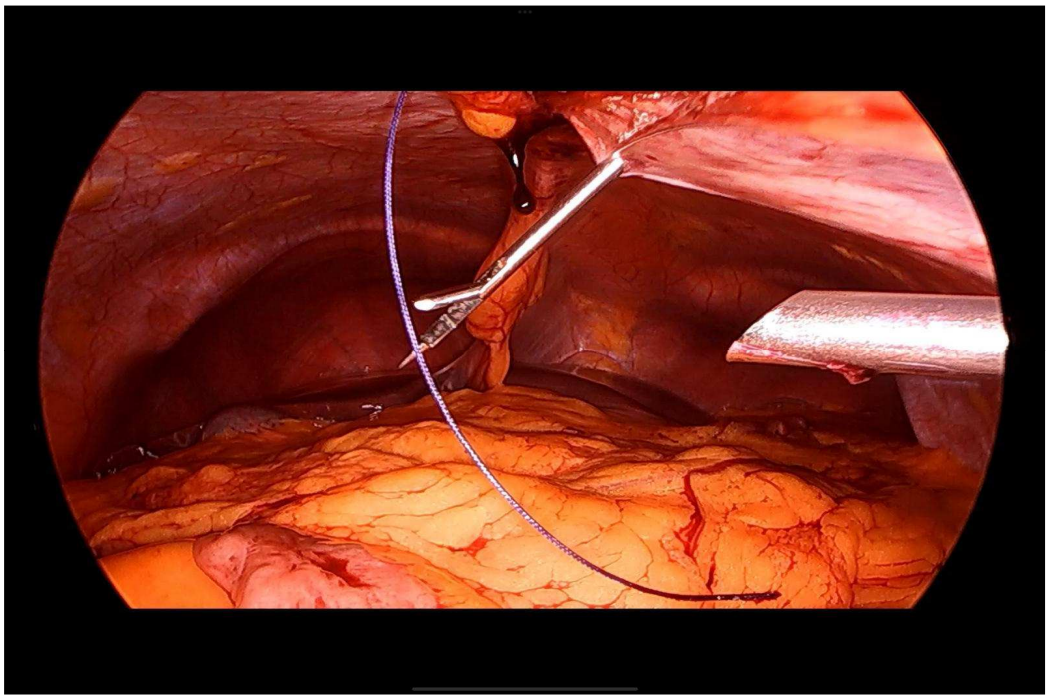


Figure 9: PDS suture caught with suture Passer from other side of the port

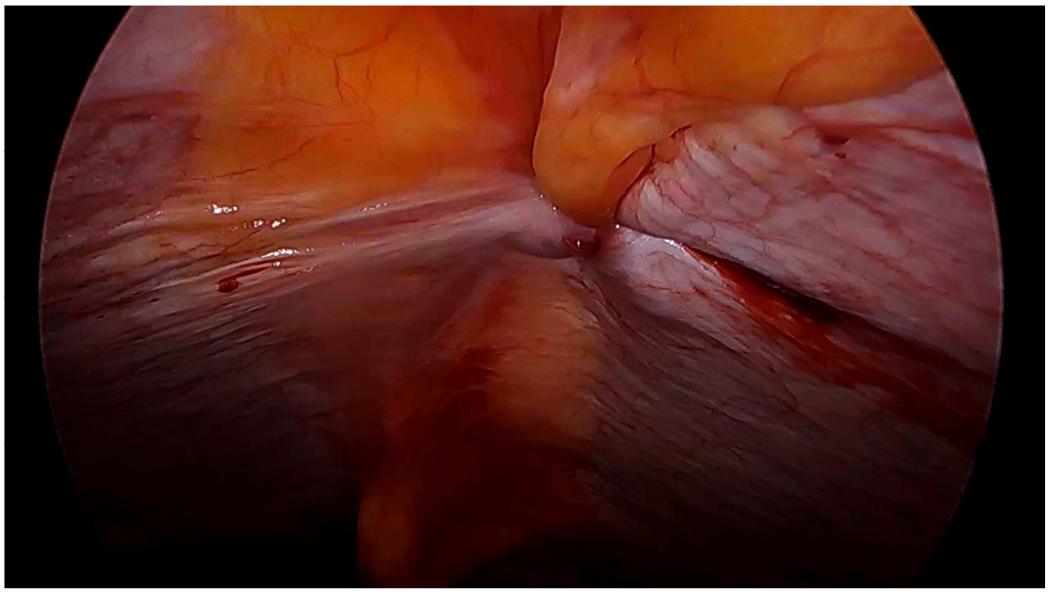


Figure 10: Umbilical Port after closure

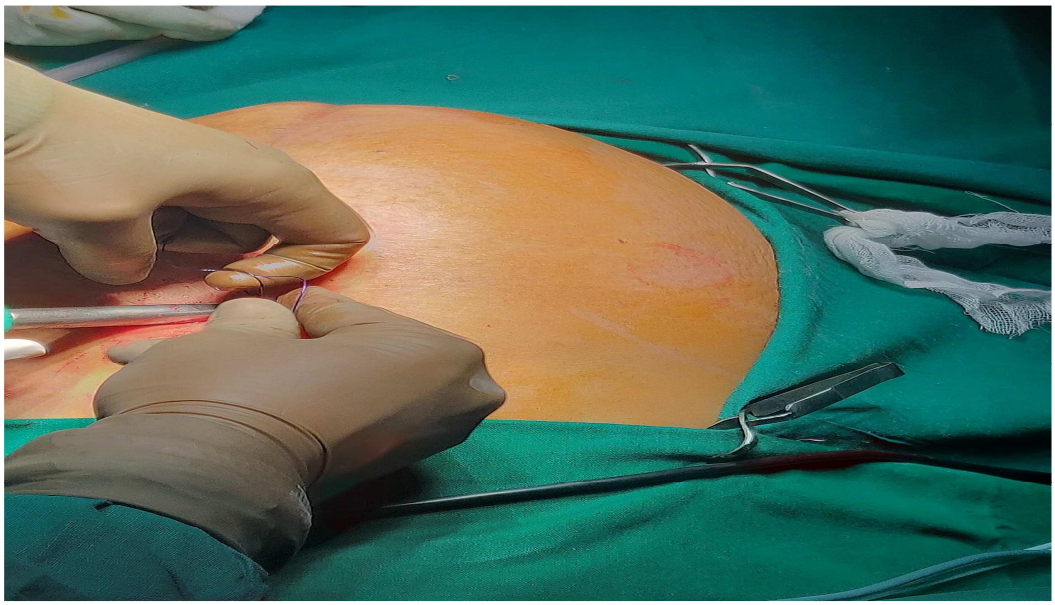


Figure 11: Knot Tying and umbilical Port site closed

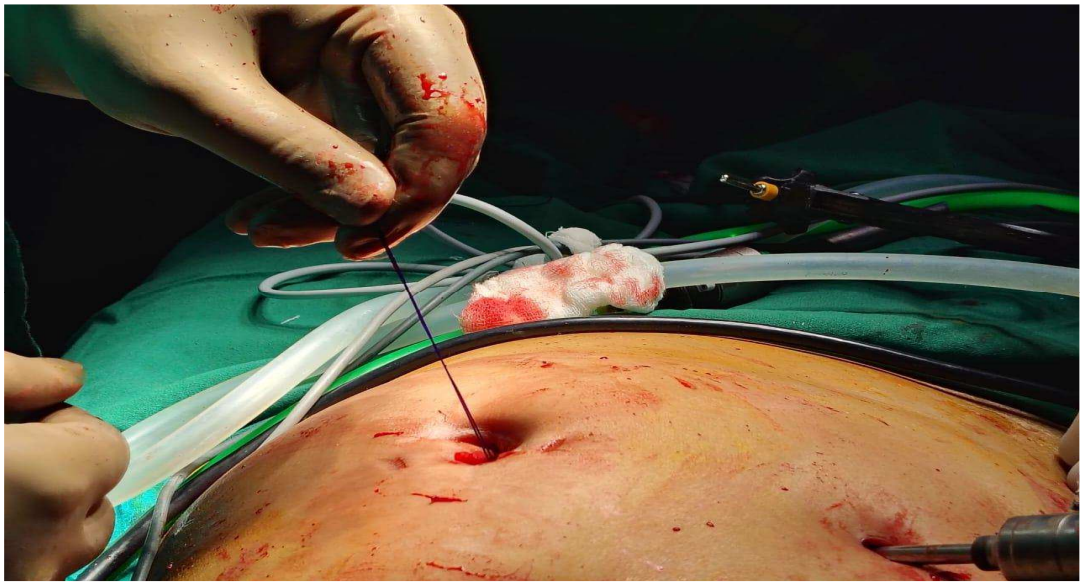
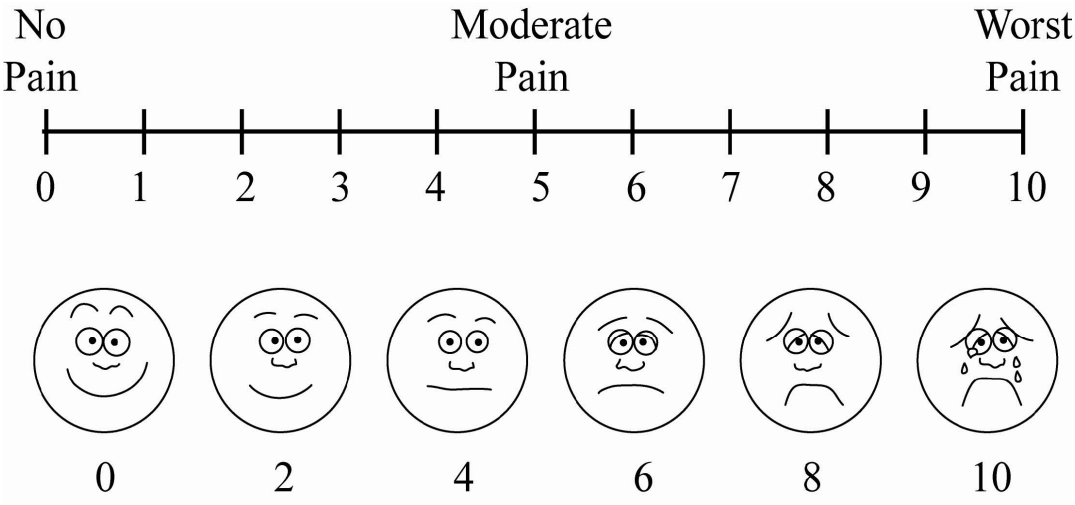


Figure 12: Remaining suture cut from outside

Assessment:

The patients from both the groups was assessed for post operative pain during 12h - 24h - 48h and 3 months using the Visual Analogue Scale.

Figure 13: Visual Analog Scale



The patients in both the groups will be assessed for any Surgical Site Infection on ,POD-3 and on POD - 10 day using the Southampton Wound Scoring System.

Data Analysis & Interpretation:

Data was entered in MS Excel and analysed using SPSS software version 28. Descriptive statistics were either expressed as percentages or mean $\pm$ Standard deviation. Chi square test was used to look for any association between categorical variables and 't' test was used for association between continuous variables. p value of less than 0.05 was considered as statistically significant

RESULTS

A Total of 78 patients were enrolled in our study.

39 belonged to group wherein PDS was used and the remaining 39 was prolene using group

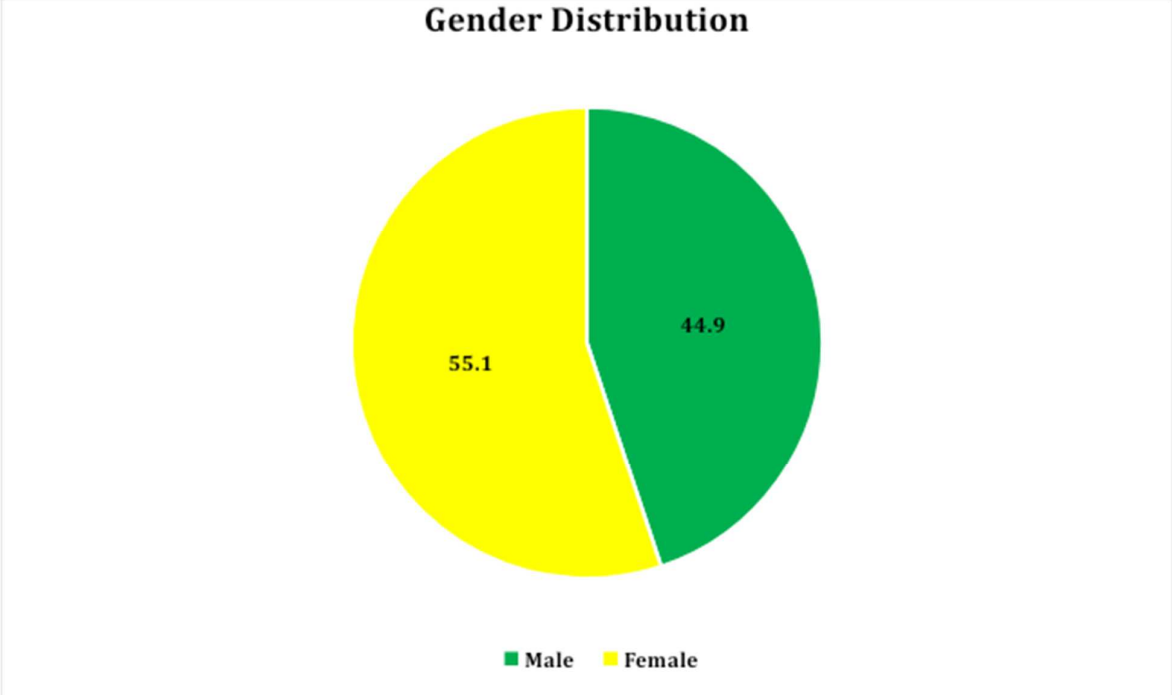
GENDER DISTRIBUTION-OVERALL

The overall gender distribution is given below. 55.1% of them were females and the remaining 44.9% of them were males in our study

Table 2: Gender Distribution-Overall

Gender	Frequency (N)	Percentage (%)
Male	35	44.9
Female	43	55.1

Figure 14: Gender Distribution-Overall



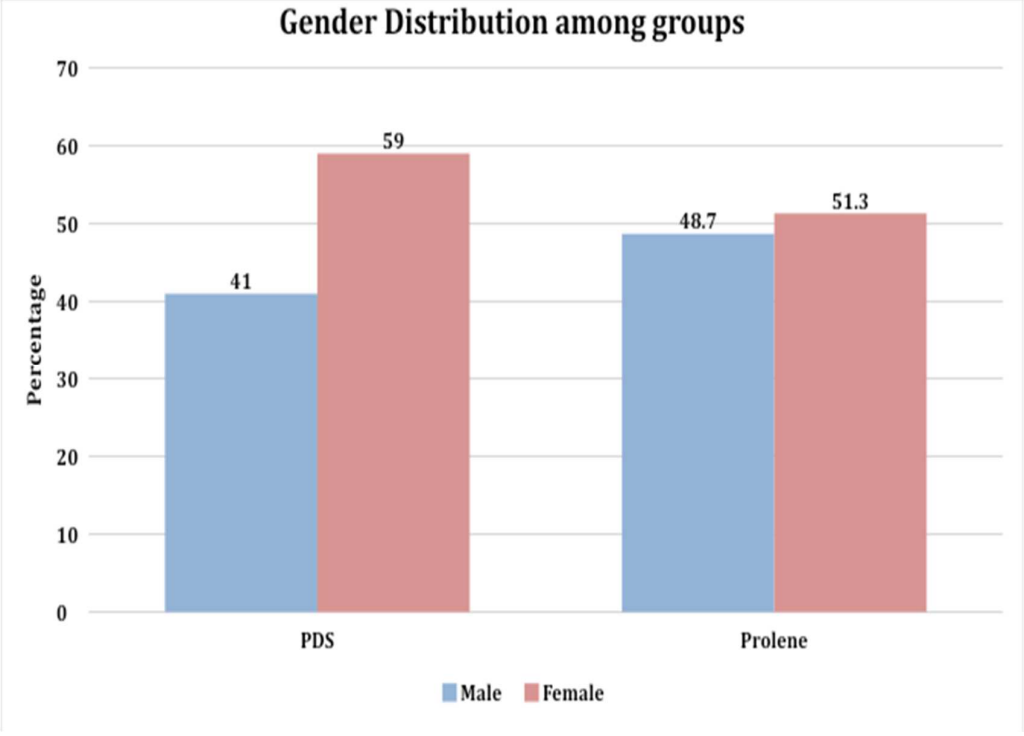
GENDER DISTRIBUTION ACCORDING TO GROUPS

In the group wise distribution of gender, males and females were as follows, males were 41% and 48.7% in the PDS and prolene groups respectively. Females comprised of 59% and 51.3% in the PDS and prolene groups respectively

Table 3: Gender Distribution among the groups

Gender	Group N(%)	
	PDS(Group -A)	Prolene(Group -B)
Male	16 (41)	19 (48.7)
Female	23 (59)	20 (51.3)

Figure 15: Gender Distribution among the groups



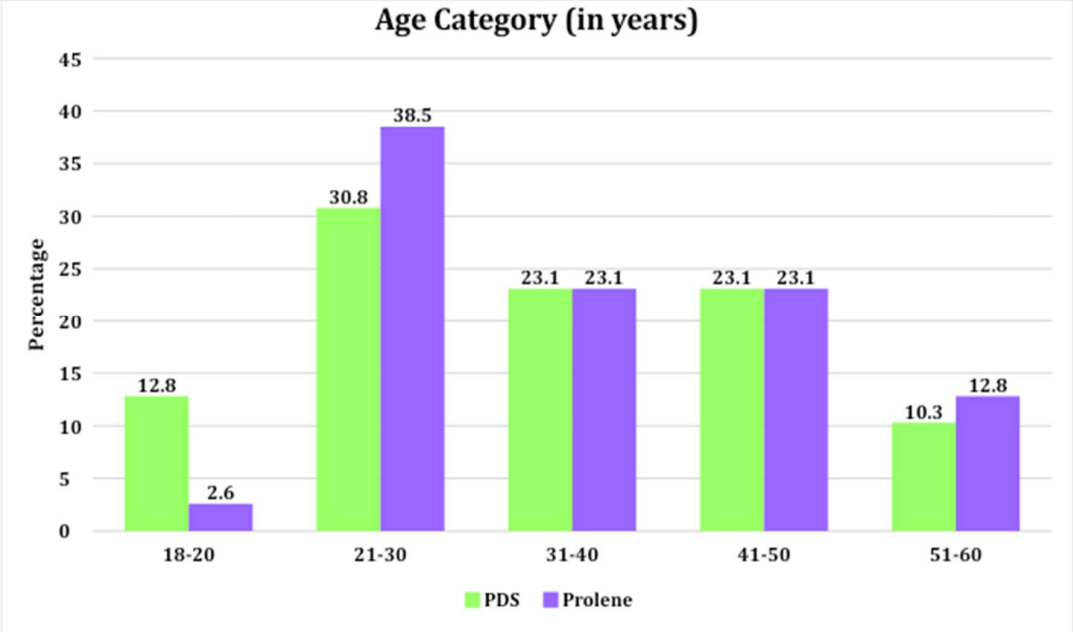
AGE CATEGORY

The age categories of persons in two groups were compared and it showed that in both the groups majority belonged to 21-30 years age category with 30.8% in the PDS group and 38.5% in the prolene group

Table 4: Age Category (in years)

Age Category (in years)	Group N(%)	
	PDS(Group -A)	Prolene(Group -B)
18-20	5 (12.8)	1 (2.6)
21-30	12 (30.8)	15 (38.5)
31-40	9 (23.1)	9 (23.1)
41-50	9 (23.1)	9 (23.1)
51-60	4 (10.3)	5 (12.8)

Figure 16: Age Category (in years)



DESCRIPTIVE STATISTICS BASED ON GENDER

The table below shows the mean and standard deviation of the persons in both the groups. There are some variation in mean levels based on gender. Variables like Hb, Weight and age had some mean differences with regards to gender

Table 5: Descriptive Statistics Based On Gender

Variable	**Sub Category**	**Group (Mean ± SD)**	
		PDS(Group -A)	**Prolene(Group -B)**
Age (in years)	Female	32.91 ± 11.35	36.95 ± 12.06
	Male	37.37 ± 13.53	36.42 ± 9.32
Weight (in Kg)	Female	61.87 ± 7.65	62.30 ± 6.99
	Male	69.25 ± 9.35	70.53 ± 8.40
Hb (g/dl)	Female	12.17 ± 0.84	12.33 ± 1.57
	Male	14.23 ± 1.55	13.95 ± 1.08
Total Protein	Female	7.17 ± 0.61	7.24 ± 0.47
	Male	7.18 ± 0.54	7.31± 0.56
Albumin	Female	4.32 ± 0.45	4.12 ± 0.77
	Male	4.17 ± 0.76	4.33 ± 0.50

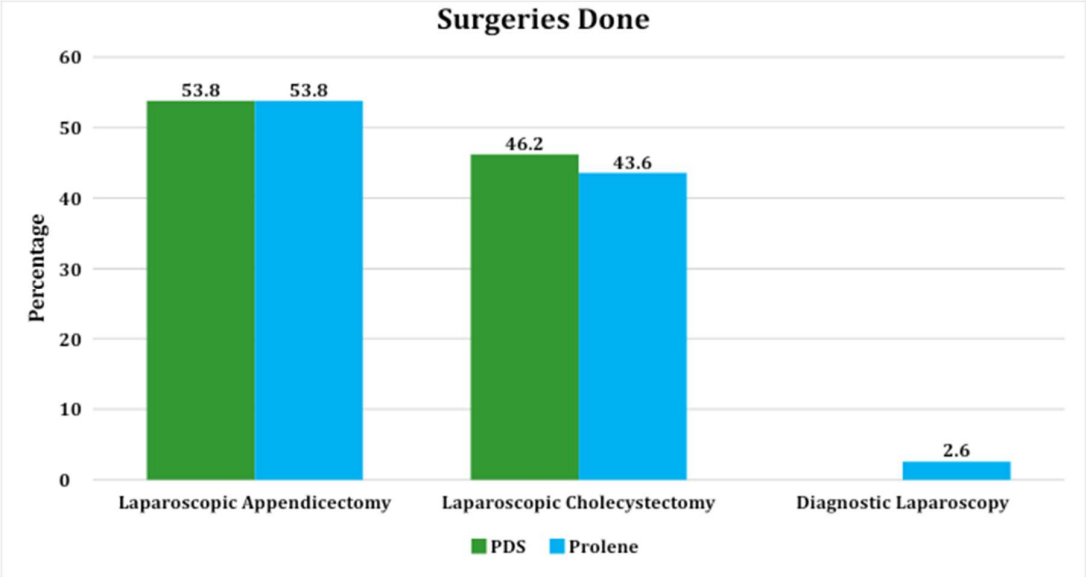
SURGERIES DONE

Three surgeries were performed on the study participants. Laparoscopic Appendicectomy was done in 21(53.8%) patients in both the groups.. Likewise, PDS was used in 18 (46.2%) of them undergoing Laparoscopic Cholecystectomy and prolene was used in 17 (43.6%) of them undergoing the same procedure.Prolene was used in one patient who underwent Diagnostic Laparoscopy.

Table 6: Surgeries Done

Surgeries Done	Group N(%)	
	PDS(Group -A)	Prolene(Group -B)
Laparoscopic Appendicectomy	21 (53.8)	21 (53.8)
Laparoscopic Cholecystectomy	18 (46.2)	17 (43.6)
Diagnostic Laparoscopy	0	1 (2.6)

Figure 17: Surgeries Done



SURGERIES BASED ON GENDER

The table below shows a gender wise distribution of the various surgeries done on the study participants. While 65.7% of Laparoscopic Appendicectomy was performed on males, 55.8% of females had Laparoscopic Cholecystectomy being done

Table 7: Surgeries Based on Gender

Surgeries Done	Group N (%)	
	Female	**Male**
Laparoscopic Appendicectomy	19 (44.2)	23 (65.7)
Laparoscopic Cholecystectomy	24 (55.8)	11 (31.4)
Diagnostic Laparoscopy	0	1 (2.9)

And among those surgeries performed, PDS was used 57.9% and prolene was used in 42.1%females undergoing Laparoscopic Appendicectomy and PDS was used 43.5% and prolene used in 56.5% in males undergoing Laparoscopic Appendicectomy. Similarly, PDS was used 50% and prolene was used in 50%females undergoing Laparoscopic Cholecystectomy and PDS was used 54.5% and prolene used in 45.5% in males undergoing Laparoscopic Cholecystectomy

Table 8: Surgeries Done based on gender between the groups

Surgeries Done	Sub Category	Group N (%)	
		PDS(Group -A)	Prolene(Group -B)
Laparoscopic Appendicectomy	Female	11 (57.9)	8 (42.1)
	Male	10 (43.5)	13 (56.5)
Laparoscopic Cholecystectomy	Female	12 (50)	12 (50)
	Male	6 (54.5)	5 (45.5)
Diagnostic Laparoscopy	Female	0	0
	Male	0	1 (100)

DURATION OF SURGERY (in minutes)

The mean duration of surgery of laparoscopic appendicectomy with PDS and prolene was 55.48 and 60.76 minutes and for laparoscopic cholecystectomy it was 68.06 and 75.29 minutes

Table 9: Duration of Surgery

Surgery Done	Group	Duration of Surgery (in min)
		Mean ± SD
Laparoscopic Appendicectomy	PDS	55.48 ± 18.30
	Prolene	60.76 ± 29.05
Laparoscopic Cholecystectomy	PDS	68.06 ± 23.65
	Prolene	75.29 ± 26.49
Diagnostic Laparoscopy	PDS	0
	Prolene	45

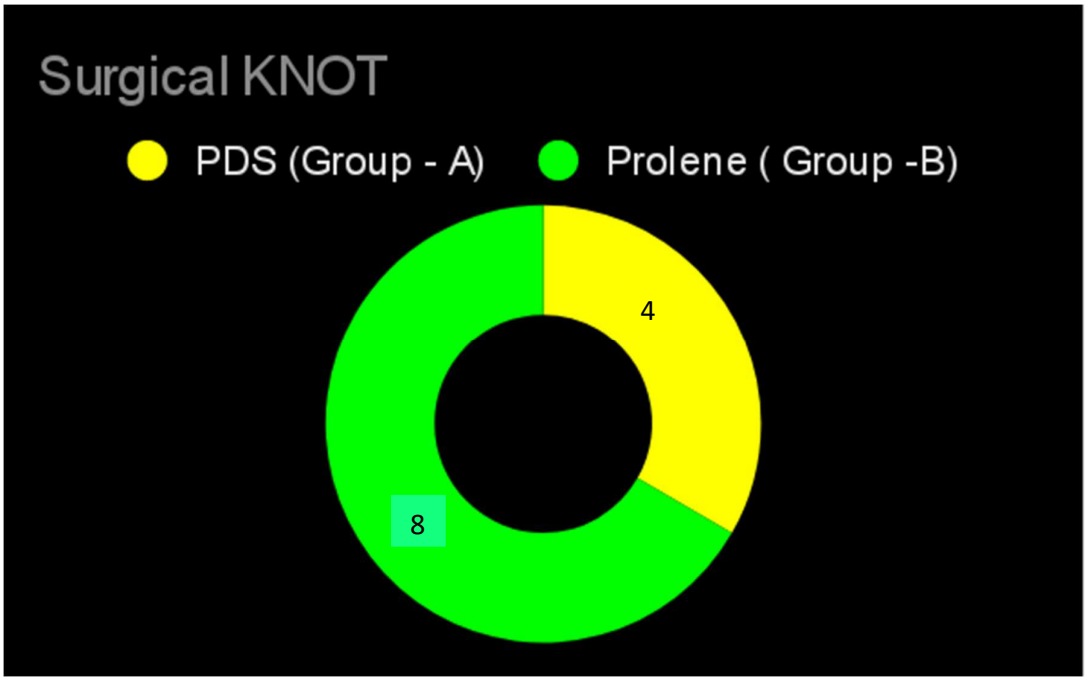
Suture Knot

The suture knots at umblical Port site was palpable in 4 patient in whom PDS Sutures were used and around 8 Patients where Prolene sutures were used at 3 months after surgery.

Table 10: Suture Knot

Suture Knot	Palpable	Not palpable
PDS (Group - A)	4	35
Prolene (Group -B)	8	31

Figure 18: Surgical Knot



PAIN- VAS

The pain using VAS was compared at 12 hours, 24 hours, 48 hours and 3 months

Table 11: Pain- VAS

VAS	Sub category	Group N (%)		p value
		PDS	**Prolene**	
12 hours	Less Pain	39 (100)	37 (94.9)	0.127
	Pain	0	2 (5.1)	
24 hours	Less Pain	27 (69.2)	25 (64.1)	0.256
	Pain	12 (30.8)	14 (35.9)	
48 hours	Less Pain	29 (74.4)	25 (64.1)	0.361
	Pain	10 (25.6)	14 (35.9)	
3 months	Less Pain	35 (89.7)	29 (74.4)	**0.001**
	Pain	4 (10.3)	10 (25.6)	

At 12 hours post-surgery, VAS score for the PDS group was recorded notably lower than that was observed in the Prolene group (p =0.127). This difference persisted at 24 and 48 hours postoperatively with p values of 0.256 and 0.361 respectively which was not statistically significant. But at 3 months it was found to be statistically significant with pain being less in the group which used PDS, as the p value was less than 0.05

Southampton Wound Scoring System

GRADE 0	Nonnal Healing
GRADE I Normal Healing with mild bruising or erythema	A Some brulsing B Considerable bruising C Mild erythema
GRADE II Brythema plus other signs of inflammation	A At one point B Around sutures C Along wound D Around wound
GRADE III Clear or Haemoserous discharge	A At one point only(<20m) B. Along wound (>2cm) C Large volume D Prolonged (>3days)
GRADE IV Pus	A At one point only (<2cm) B Along wound (>2cm)
GRADE V	Deep or severe wound infection with or without tissue breakdown; hematoma requiring aspiration

Southampton Score on POD III

The Southampton score was used for wound assessment and it was observed that 16 patients in group using PDS and 18 patients in group using prolene had wound Infection. 23 (58.9%) of Patients in PDS Group and 21 (53.9%) Patients of Prolene group had normal wound Healing.No patients with Grade 4, Grade 5 wound Infection was noted in both the groups.

Table 12: Southampton Score on POD III

South Ampton Score	Sub category	Group N (%)		p value
		PDS (Group -A)	Prolene (Group -B)	
0		23 (58.9)	21 (53.9)	
Grade 1	A	5 (12.9)	4 (10.2)	0.124
	B	2 (5.1)	1 (2.6)	
	C	1 (2.6)	3 (7.7)	
Grade II	A	2 (5.1)	2 (5.1)	0.245
	B	1 (2.6)	0	
	C	2 (5.1)	2 (5.1)	
	D	0	2 (5.1)	
Grade III	A	2 (5.1)	3 (7.7)	0.789
	B	1 (2.6)	1 (2.6)	
Grade IV		0	0	
Grade V		0	0	

Southampton Score on POD X

The Southampton score was used for wound assessment and it was observed that 8 patients in group using PDS and 10 patients in group using prolene had wound infections. 31(79.4%) of Patients in PDS Group and 29 (74.2%) Patients of Prolene group had normal wound Healing. No patients with Grade 4, Grade 5 wound Infection was noted in both the groups.

Table 13: Southampton Score on POD X

Southampton Score	Sub category	Group N(%)		p value
		PDS (Group -A)	Prolene (Group - B)	
0		31(79.4%)	29(74.2%)	
Grade 1	A	1 (2.6)	2 (5.1)	0.654
	B	2 (5.1)	1 (2.6)	
	C	1 (2.6)	1 (2.6)	
Grade II	A	2 (5.1)	2 (5.1)	0.124
	B	0	1 (2.6)	
	C	1 (2.6)	1 (2.6)	
	D	0	0	
Grade III	A	1 (2.6)	1 (2.6)	0.561
	B	0	1 (2.6)	
Grade IV		0	0	
Grade V		0	0	

INDEPENDENT 't' TEST

It is seen that using a 't' test VAS score at 3 months was found to have statistically significant mean difference in PDS group with a p value of less than 0.05

Table 14: Independent 't' Test

Variable	Sub Category	Mean And SD		p value
		Mean	**SD**	
Age (in years)	PDS	34.72	12.32	0.452
	Prolene	36.69	10.68	
Weight (in kg)	PDS	64.90	9.06	0.485
	Prolene	66.31	8.67	
Hb (g/dl)	PDS	13.01	1.55	0.761
	Prolene	13.12	1.57	
Total Protein	PDS	7.17	0.57	0.429
	Prolene	7.27	0.51	
Albumin	PDS	4.26	0.60	0.816
	Prolene	4.22	0.66	
Duration of surgery	PDS	69.36	20.69	0.228
	Prolene	76.15	28.13	
VAS @ 12 hours	PDS	5.97	1.11	0.141
	Prolene	7.82	0.790	
VAS @ 24 hours	PDS	3.79	1.01	0.245
	Prolene	6.10	1.23	
VAS @ 48 hours	PDS	2.23	1.01	0.754
	Prolene	5.15	1.51	
VAS @ 3months	PDS	.31	0.95	**<0.001**
	Prolene	.69	1.32	

DISCUSSION

The primary objective of this study was to compare the efficacy and safety of non-absorbable polypropylene and absorbable polydioxanone sutures in umbilical port site closure following laparoscopic procedures. Given the increasing focus on optimizing surgical outcomes, this study aimed to evaluate postoperative complications, including surgical site infection (SSI), postoperative pain.

Gender Distribution

The present study included a total of 78 participants, with a slight predominance of females 43 (55.1%) over males 35 (44.9%) Patients. When analyzing the distribution based on the suture type used, the gender ratio remained relatively balanced across the two groups. In the polydioxanone (PDS) group, 16 (41%) of the participants were male, while 19 (48.7%) of the polypropylene (Prolene) group were male. Among the female participants, 23 (59%) were assigned to the PDS group, whereas 20 (51.3%) were in the Prolene group. This minor variation in gender distribution is unlikely to have had a major influence on the study outcomes, as the proportions remained comparable between groups. Given the balanced gender representation, any potential differences in wound healing, postoperative pain perception, or complications are expected to be independent of gender bias.

studies conducted by Bloemen et al. [32] and Pai et al. [35] included both male and female participants undergoing elective midline laparotomy. The inclusion of both genders suggests that findings from these studies are widely applicable across diverse patient populations, regardless of sex-specific physiological variations.

Age Distribution

In this study, the age range of participants varied from 18 to 60 years, with an approximately similar distribution in both study groups. The majority of individuals were between 21 and 50 years of age, ensuring a reasonable age balance between the groups. The average age among females was 32.91 ± 11.35 years in the PDS group and 36.95 ± 12.06 years in the Prolene group. Among males, the mean age was nearly identical between groups, with values of 37.37 ± 13.53 years for the PDS group and 36.42 ± 9.32 years for the Prolene group. These findings confirm that both study groups were adequately matched in terms of age, thereby minimizing potential age-related confounders that could impact wound healing, postoperative pain, or surgical recovery.

Pai et al. [35] ensured that both study groups maintained similar age distributions to reduce confounding variables. Zucker et al. [40] included studies with a broad range of adult patients, enhancing the generalizability of their findings across different age demographics. These observations suggest that while age may influence wound healing and hernia formation, it was not a primary variable in most comparative analyses.Bosanquet et al. [41] identified advanced age as a key risk factor for the development of incisional hernia (IH), indicating that aging-related declines in tissue integrity and healing capacity might impact surgical outcomes.

Baseline Clinical Parameters

In the current study, a comprehensive comparison of baseline clinical parameters, including weight, hemoglobin (Hb) levels, total protein, and albumin levels, revealed no significant differences between the two groups. The average weight among female participants was recorded as 61.87 ± 7.65 kg in the PDS group and 62.30 ± 6.99 kg in the Prolene group, whereas male participants had a mean

weight of 69.25 ± 9.35 kg and 70.53 ± 8.40 kg in the respective groups. Hemoglobin levels were also nearly identical between groups, with no significant variations observed. These similarities reinforce that both groups were comparable at baseline, ensuring that any observed differences in postoperative outcomes were unlikely to be attributed to pre-existing clinical disparities.

Additionally, Tyagi and Raza[33] provided insights into global trends in abdominal surgery, indirectly shedding light on how patient populations with varying comorbid conditions and demographic characteristics are managed. Bosanquet et al. [41] highlighted that obesity and prior laparotomies were significant contributors to the risk of incisional hernia formation.

Types of Surgeries Performed

Among the study population of the present study, the majority underwent laparoscopic appendicectomy, accounting for 53.8% in both suture groups. The next most common procedure was laparoscopic cholecystectomy, which was performed in 46.2% of the PDS group and 43.6% of the Prolene group. Additionally, there was one case of diagnostic laparoscopy, recorded in the Prolene group. When assessing gender-specific variations, male participants were found to have a higher likelihood of undergoing laparoscopic appendicectomy (65.7%) compared to females (44.2%), whereas females exhibited a greater tendency to undergo laparoscopic cholecystectomy (55.8%) in contrast to males (31.4%). These differences are reflective of the general prevalence of these conditions in males and females rather than any intentional bias in surgical selection or group assignment.

studies, including those by Bloemen et al. [32] and Cameron et al. [34], assessed various fascial closure methods in laparotomies. Kon et al. [42 compared different suture materials, contributing to preclinical insights on their mechanical and

biological properties. Shankar et al. [38] focused on evaluating multiple commercial brands of polydioxanone sutures, comparing their performance in clinical settings.

Duration of Surgery

In this study, analysis of the mean operative times revealed slight variations between the two suture groups. For laparoscopic appendicectomy, the mean operative time was slightly lower in the PDS group at 55.48 ± 18.30 minutes, compared to 60.76 ± 29.05 minutes in the Prolene group. Similarly, in laparoscopic cholecystectomy, the mean duration was shorter in the PDS group (68.06 ± 23.65 minutes) than in the Prolene group (75.29 ± 26.49 minutes). The only recorded diagnostic laparoscopy case in the Prolene group had a surgical duration of 45 minutes. Although there was a general trend of reduced operative time in the PDS group across procedures, the difference did not achieve statistical significance ($p = 0.228$), suggesting that other factors, such as surgeon expertise and patient-specific anatomical variations, may contribute to surgical duration.

Pai et al. [35] reported that surgeries involving polypropylene sutures had a longer operative duration (P=0.020). A subgroup analysis revealed that when surgery lasted under four hours, there was no significant difference in infection rates (P=0.320). Despite this, most studies did not explicitly investigate the impact of prolonged operative time on long-term surgical outcomes. The relationship between suture type, operative duration, and postoperative complications remains an area requiring further exploration.

Postoperative Pain (VAS Score)

In the present study, postoperative pain was assessed using the Visual Analog Scale (VAS), revealing a significant disparity between the two suture materials, particularly at 3 months. At 12 hours post-surgery, the mean VAS score for the PDS

group was recorded as 5.97 ± 1.11, notably lower than the 7.82 ± 0.79 observed in the Prolene group (p =0.127). This difference persisted at 24 and 48 hours postoperatively, with the PDS group consistently experiencing lower pain levels compared to the Prolene group However,the difference was no longer statistically significant. At the 3-month follow-up, pain levels had declined in both groups, and the difference was statistically significant (p = 0.001). These findings strongly indicate that PDS sutures may contribute to lower Late postoperative pain, potentially enhancing patient comfort and recovery in the immediate postoperative phase.

Naz et al. [37] utilized the Visual Analog Scale (VAS) to assess postoperative pain levels. The polydioxanone suture group exhibited lower pain scores, with 32.6% of patients reporting no pain compared to 26.5% in the polypropylene cohort. Severe pain (VAS 7–9) was significantly more prevalent among patients with polypropylene sutures (40.6%) versus those with polydioxanone sutures (10.6%). Cameron et al. [34] also reported reduced postoperative wound pain in the polydioxanone group, with pain occurring in 12% of patients compared to 23% in the polypropylene group (P=0.06). These findings suggest that suture material influences postoperative comfort and could be an important consideration when selecting closure techniques.

Surgical Site Infection (Southampton Score)

In the current study, surgical site infections (SSI) were evaluated using the Southampton scoring system on postoperative day (POD) 3 and 10. On POD 3, 23 (58.9%) patients of PDS group patients had a score of 0 (indicating no infection), compared to 21 (53.9%) patients in the Prolene group. A minor proportion of patients developed mild to moderate SSIs (Grades I and II) in both groups. By POD 10, a larger number of participants demonstrated complete wound healing, with 31 (79.4%) patients in the PDS group and 29 (74.2%) in the Prolene group scoring 0 on the

Southampton scale. Importantly, no instances of severe infections (Grade IV or V) were observed in either group. These results affirm that both suture types are generally safe, with a low likelihood of severe postoperative wound infections.

Multiple studies investigated the incidence of surgical site infections (SSI) in relation to suture material. Pai et al. [35] reported a significantly higher SSI rate in patients who received polypropylene sutures (P=0.031).Tyagi and Raza [33] found that PDS Plus had the lowest infection rate (3.3%) compared to PDS II (26.7%). Naz et al. [37] recorded an infection rate of 33.9% for polydioxanone and 67.1% for polypropylene. Shankar et al. [38] found comparable infection rates between PD Synth and PDS groups, highlighting the clinical similarities among different brands of polydioxanone sutures. These studies reinforce the potential benefits of polydioxanone in reducing infection risks postoperatively.

Knot Profile

In the present study, the surgical knot was palpable in 4 patients (10.3% of the cases) in the PDS group and 8 Patients (20.6% of the cases) in the prolene group. The prolene group had approximately twice the rate of palpable knots compared to the PDS group.Bloeman et al. [32] reported that polydioxanone sutures offer distinct advantages over prolene sutures, including fewer palpable knots,lower rates of surgical site infections and reduced postoperative pain.

Statistical Significance

Statistical comparisons using independent t-tests confirmed that demographic and baseline clinical characteristics exhibited no statistically significant differences between groups. However, postoperative pain assessments at 3 Months revealed significantly lower VAS scores in the PDS group ($p < 0.001$). Differences in surgical duration and SSI rates between groups did not reach statistical significance.

[34] Cameron et al. reported that polydioxanone sutures significantly reduced the risk of wound dehiscence compared to polypropylene (0.7% vs. 6.4%, P=0.018). Pai et al. [35] conducted a subgroup analysis based on operative duration to further investigate outcome variations. Zucker et al. [40] employed network meta-analysis to compare multiple suture materials across different studies, while Bosanquet et al. [41] used meta-regression techniques to assess patient-related risk factors for incisional hernia. Bloemen et al. [32] applied Kaplan-Meier survival analysis, demonstrating no statistically significant difference in cumulative incisional hernia rates (P=0.222).

Interpretation of Findings

The study findings suggest that polydioxanone (PDS) sutures may be a preferable choice over polypropylene (Prolene) for umbilical port site closure, primarily due to their association with significantly reduced postoperative pain and fewer detectable knots under the skin at 3 months of Follow up. While operative times exhibited a marginal decrease in the PDS group, this was not statistically significant. Furthermore, SSI rates remained comparable between groups, reinforcing the safety profile of both materials. The observed advantages of PDS in pain reduction and roughly half the number of palpable knots highlight its potential as an effective suture alternative in laparoscopic procedures.

Overall, the collective evidence suggests that polydioxanone sutures offer distinct advantages, including lower rates of surgical site infections, reduced postoperative pain, and fewer palpable knots compared to polypropylene sutures. However, multiple studies, including those by Bloemen et al. [32], Cameron et al. [34], and Sajid et al. [39], found no significant differences in the long-term incidence of incisional hernias between suture types.

. Tyagi and Raza [33] reported that while PDS Plus had superior infection control properties, cost-effectiveness remains a concern. Albahadili et al. [36] found that polydioxanone reduced wound sinus formation, further supporting its advantages in wound healing. Shankar et al. [38] concluded that different brands of polydioxanone sutures exhibited similar clinical performance. Bosanquet et al. [41] highlighted that patient-specific factors, such as obesity and prior surgeries, played a greater role in IH risk than suture material selection alone

Clinical Implications

The findings of this study carry significant clinical implications, particularly in the context of laparoscopic surgery, where umbilical port site closure is a critical step in ensuring optimal wound healing and reducing postoperative morbidity.

1. ***Reduction in Surgical Site Infections (SSI):***

   The results align with previous research indicating that polydioxanone sutures may be associated with a lower incidence of SSI (Tyagi and Raza [33], Naz et al. [37]). This could be attributed to its monofilament structure, which minimizes bacterial adherence. The lower infection rates observed with polydioxanone suggest its potential superiority in preventing wound complications, particularly in patients with comorbidities predisposing them to infection.

2. ***Postoperative Pain and Patient Comfort***:

   A crucial aspect of postoperative recovery is pain management, and this study reinforces previous findings that polydioxanone sutures result in lower postoperative pain scores (Naz et al. [37], Cameron et al. [34]). The reduced incidence of severe pain (VAS 7–9) in the polydioxanone group highlights its advantage in patient comfort and early mobilization. This has direct

implications for enhanced recovery after surgery (ERAS) protocols, which emphasize pain control and early discharge.

3. Palpable Knots

Prolene sutures resulted in twice as many palpable knots compared to PDS sutures (20.6% vs. 10.3%). Bloeman et al. [32] reported that polydioxanone sutures offer distinct advantages over prolene sutures, including fewer palpable knots,lower rates of surgical site infections and reduced postoperative pain.This highlight that PDS sutures promote enhanced patient comfort after surgical procedure.

4. ***Long-Term Wound Integrity and Incisional Hernia Risk***:

The incidence of incisional hernia remains a key concern in surgical wound closure. While previous studies have shown mixed results regarding suture material and hernia rates (Bloemen et al. [32], Bosanquet et al. [41]), this study contributes further clarity by analyzing the role of polydioxanone and polypropylene in umbilical port site closure specifically. Given that age and comorbid conditions influence hernia formation (Bosanquet et al. [41]), patient selection and tailored suture choice may play a pivotal role in reducing long-term complications. our study assessed for any Hernias untill 3 months , further Long term follow up is required to assess the inscidence of Port site Hernias

5. ***Cost-Effectiveness***:

Despite its clinical benefits, the higher cost of polydioxanone sutures has been a topic of discussion (Tyagi and Raza [33]). The balance between improved clinical outcomes and financial feasibility remains a crucial consideration in resource-limited settings. Hospitals and surgical centers must weigh the

potential reduction in SSI and postoperative pain against the economic impact of using absorbable sutures.

6. ***Broader Surgical Applications***:

   The findings suggest that the principles observed in midline laparotomy closure (Pai et al. [35], Sajid et al. [39]) may extend to laparoscopic port site closure. However, further randomized controlled trials are necessary to validate these findings in larger patient cohorts and across different surgical specialties.

Overall, this study highlights the potential advantages of polydioxanone sutures in reducing postoperative complications, particularly in infection control, Lower palpable knot and pain reduction. However, given the comparable incisional hernia rates between suture types, the choice of suture material should be guided by patient-specific factors and institutional resources.

Strengths of the study:

- This study systematically compared absorbable polydioxanone and non-absorbable polypropylene sutures, evaluating key clinical outcomes such as postoperative pain and surgical site infection (SSI) .
- The use of standardized scoring systems, including the Visual Analog Scale (VAS) for pain and the Southampton Score for SSI, enhanced the reliability of outcome measurements.
- Inclusion of patients undergoing various laparoscopic procedures increased the generalizability of the findings to broader surgical practice.
- The study provides practical guidance for surgeons on optimal suture material selection for umbilical port site closure, directly impacting patient recovery and postoperative morbidity.

Limitations of the study:

- Limited Sample Size: A larger cohort would have provided greater statistical power to detect subtle differences in long-term outcomes such as incisional hernia rates.
- Short Follow-Up Duration: The study primarily focused on early postoperative complications, with limited data on long-term wound integrity and Port site hernia formation.
- Single-Center Design: Results may not be fully generalizable to other institutions with different patient demographics and surgical practices.

CONCLUSION

This study compared the postoperative port site complications following closure of 10 mm umbilical port sites using absorbable polydioxanone (PDS) and non-absorbable polypropylene (Prolene) sutures in patients undergoing elective laparoscopic surgeries. The findings demonstrated that patients in the PDS group experienced significantly lower postoperative pain at 12, 24, and 48 hours, as reflected by mean Visual Analog Scale (VAS) scores of 5.97 ± 1.11, 3.79 ± 1.01, and 2.23 ± 1.01, respectively, compared to 7.82 ± 0.79, 6.10 ± 1.23, and 5.15 ± 1.51 in the Prolene group. At 3 months, residual pain was lower in the PDS group (10.3%) than in the Prolene group (25.6%).

The incidence of surgical site infection (SSI), assessed using the Southampton Score, was comparable between groups on postoperative day 3 and day 10, with minor variations in wound healing grades. No cases of severe wound infections (Grade IV/V) were reported in either group. The duration of surgery did not differ significantly between groups (PDS: 69.36 ± 20.69 min vs. Prolene: 76.15 ± 28.13 min, $p = 0.228$). No Patient with umblical Port site Hernias were noted uptill 3 months of follow up . Surgical knots were Less palpable in patients who used PDS Sutures compared to Prolene Sutures..

Overall, polydioxanone sutures were associated with reduced postoperative pain without increasing SSI risk, making them a preferable choice for umbilical port site closure in laparoscopic surgeries as compared to Prolene

SUMMARY

- The study was done with the objectives of comparing post operative port site complications (pain and surgical site infections), after closure of 10mm umbilical port site with non-absorbable polypropylene and absorbable polydioxanone suture in patients undergoing elective laparoscopic surgeries.
- The study cohort included a total of 78 participants, with a slight predominance of females (55.1%) over males (44.9%).
- The age range of participants varied between 18 to 60 years, with an approximately similar distribution in both study arms. The majority of individuals were between 21 and 50 years of age, ensuring a reasonable age balance between the groups.
- The average weight among female participants was recorded as 61.87 ± 7.65 kg in the PDS group and 62.30 ± 6.99 kg in the Prolene group, whereas male participants had a mean weight of 69.25 ± 9.35 kg and 70.53 ± 8.40 kg in the respective groups.
- Among the study population, the majority underwent laparoscopic appendicectomy, accounting for 53.8% in both suture groups. The next most common procedure was laparoscopic cholecystectomy, which was performed in 46.2% of the PDS group and 43.6% of the Prolene group. Additionally, there was one instance of diagnostic laparoscopy, recorded in the Prolene group.
- When assessing gender-specific variations, male participants were found to have a higher likelihood of undergoing laparoscopic appendicectomy (65.7%) compared to females (44.2%), whereas females exhibited a greater tendency to undergo laparoscopic cholecystectomy (55.8%) in contrast to males (31.4%).
- For laparoscopic appendicectomy, the mean operative time was slightly lower in the PDS group at 55.48 ± 18.30 minutes, compared to 60.76 ± 29.05 minutes in the Prolene group.

- Similarly, in laparoscopic cholecystectomy, the mean duration was shorter in the PDS group (68.06 ± 23.65 minutes) than in the Prolene group (75.29 ± 26.49 minutes). The only recorded diagnostic laparoscopy case in the Prolene group had a surgical duration of 45 minutes.
- Although there was a general trend of reduced operative time in the PDS group across procedures, the difference did not achieve statistical significance ($p = 0.228$).
- At 3 months of follow up Surgical knots were palpable in nearly half of the patients who used PDS Sutures compared to Prolene Sutures..
- At 12 hours post-surgery, the mean VAS score for the PDS group was recorded as 5.97 ± 1.11, notably lower than the 7.82 ± 0.79 observed in the Prolene group ($p < 0.001$). This difference persisted at 24 and 48 hours postoperatively, with the PDS group consistently experiencing lower pain levels compared to the Prolene group. However, at the 3-month follow-up, pain levels had declined in both groups, and the difference was statistically significant ($p = 0.001$).
- Surgical site infections (SSI) were evaluated using the Southampton scoring system on postoperative day (POD) 3 and 10. On POD 3, 23 (58.9%) patients of PDS group patients had a score of 0 (indicating no infection), compared to 21(53.9%) patients in the Prolene group. A minor proportion of patients developed mild to moderate SSIs (Grades I and II) in both groups. By POD 10, a larger number of participants demonstrated complete wound healing, with 31 patients in the PDS group and 29 in the Prolene group scoring 0 on the Southampton scale.
- The study findings suggest that polydioxanone (PDS) sutures may be a preferable choice over polypropylene (Prolene) for umbilical port site closure, primarily due to their association with significantly reduced postoperative pain. While operative times exhibited a marginal decrease in the PDS group, this was not statistically significant.

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ANNEXURE 1 - CONSENT FORM

KAHERs JNMC

BELAGAVI

.INFORMED CONSENT FORM

COMPARISON OF NON ABSORBABLE POLYPROPYLENE AND ABSORBABLE POLYDIOXANONE SUTURE FOR UMBILICAL PORT SITE CLOSURE – A RANDOMISED CONTROLLED TRIAL

Name of Student/Principal Investigator:

Name of Guide/Co Investigators:

Introduction: The Type of suture material used for abdominal wound closure of port site in laparoscopic surgeries influences the outcome of the wound like pain and Surgical site infections. Currently there is no superiority of absorbable or non-absorbable suture materials for Laparoscopic umbilical port site closure. Aim of this study is To compare the post-operative port site complications (Pain and Surgical site infections), after closure of 10 mm umbilical Port sites with non-absorbable polypropylene and absorbable polydioxanone suture in patients undergoing elective Laparoscopic Gastrointestinal Surgeries

Explanation of procedure: All patients who give consent for this study will undergo their respective Laparoscopic surgical procedures and during the time of closure of the 10mm umbilical port will be closed either by prolene or polydioxanonebased on snose and the patients will be followed up on Post operative day – 1,2,3,14 and 3 months for post operative pain and surgical site infection.

Withdrawal from participation in the study: Participation in this study in voluntary. You will be free to decide whether to participate in this study or continue participation once

enrolled. In case you decide to withdraw your participation, you are free to do so. Before the time of surgery However, please convey the decision to the principal investigator.

Possible benefits from participating in the study: You will not get any benefits by participating in this study. The data gathered will help population at large.

Possible risks from participating in the study: There are no risks involved in participating in this study.

Privacy and confidentiality: The information collected from you will be coded, to prevent any person to identify you and Your identity will never be revealed. The data collected from you will be kept confidential and only processed or aggregated data will be used for publication.

Financial incentives: You will not receive any payment for participating in this study.

Cost of investigations done during the course of study will be paid by the principal Participant

Authorization for publication of aggregated data: Results obtained after processing of the aggregated data will be published for scientific purpose and or presented to scientific groups. However, your identity will never be revealed. this study, you are free to contact:

Questions: In case of any questions with regard to you have any question or complaints with regard to your right as study participant you may contact Dr Harsha Hegde, Chairperson, Ethical committee of JNMC, 0831-2473777 Extension 4052.

Legal rights: By signing this consent form, we are not waving any of your legal rights

CONSENT STATEMENT

I am making a voluntary decision to participate in the study COMPARISON OF NON ABSORBABLE POLYPROPYLENE AND ABSORBABLE NUMBER POLYDIOXANONE SUTURE FOR UMBILICAL PORT SITE CLOSURE - A RANDOMISED CONTROLLED TRIAL.My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Name of the participant:

Signature or left thumb impression of the participant:

Name of the witness:

Signature or left thumb impression of the witness:

Name of the investigator:

Signature of the investigator:

ANNEXURE - 2 PROFORMA

Group:

Name:

IP no.:

Sex:
Age:

Address:

Religion:

Education:

Date of admission:

Date of discharge:

Occupation:

CHIEF COMPLAINTS:

HISTORY OF PRESENTING COMPLAINTS:

PAST HISTORY:

PERSONAL HISTORY:

FAMILY HISTORY:

GENERAL PHYSICAL EXAMINATION:

Built and Nourislunent:

Weight:

Pallor/Icterus/Cyanosis/Clubbing/Edema/Lymphadenopathy

Vital Signs:

PR: /min;

BP: mm Hg:

RR: /min;

Febrile/Afebrile

SYSTEMIC EXAMINATION:

Abdomen:

Inspection:

Palpation:

Percussion:

Ascultation:

Cardio Vascular System:

Respiratory System:

CLINICAL IMPRESSION:

INVESTIGATIONS

Hemoglobin

HIV:

HBsAg:

Total Protein:

Albumin:

OPERATION DETAILS

Date of Surgery

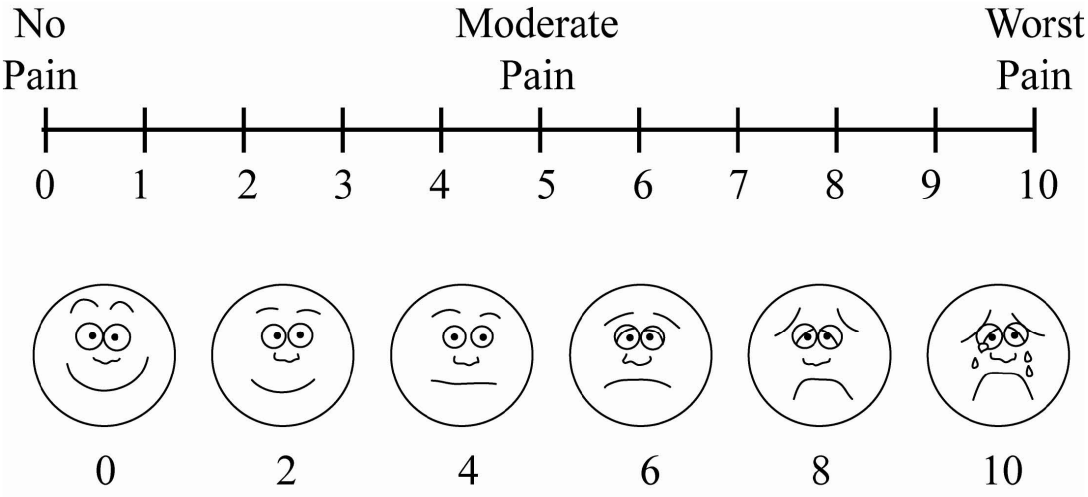
Procedure:

Anesthesia: General Anesthesia

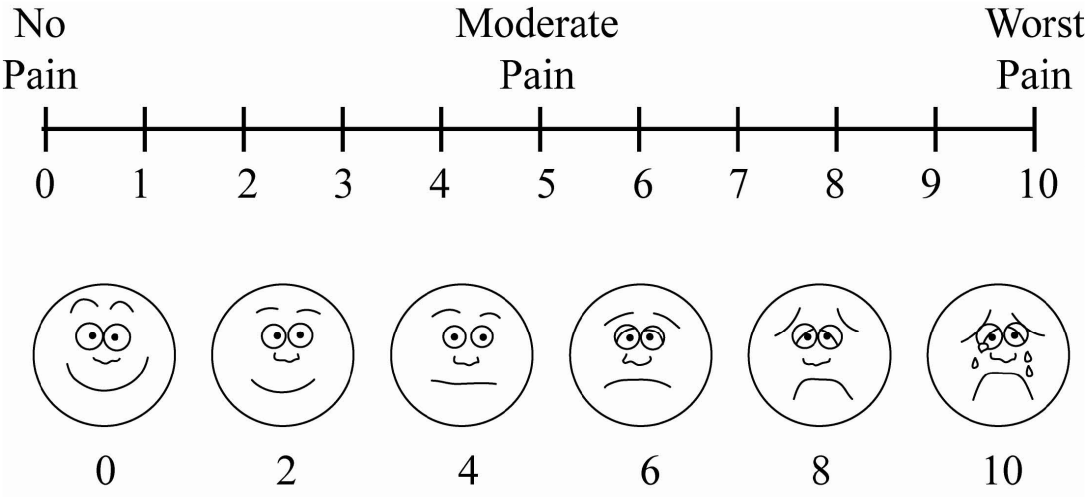
Duration of Surgery.

ASSESSMENT OF POST OPERATIVE PAIN BY VISUAL ANALOGUE SCALE (VAS):

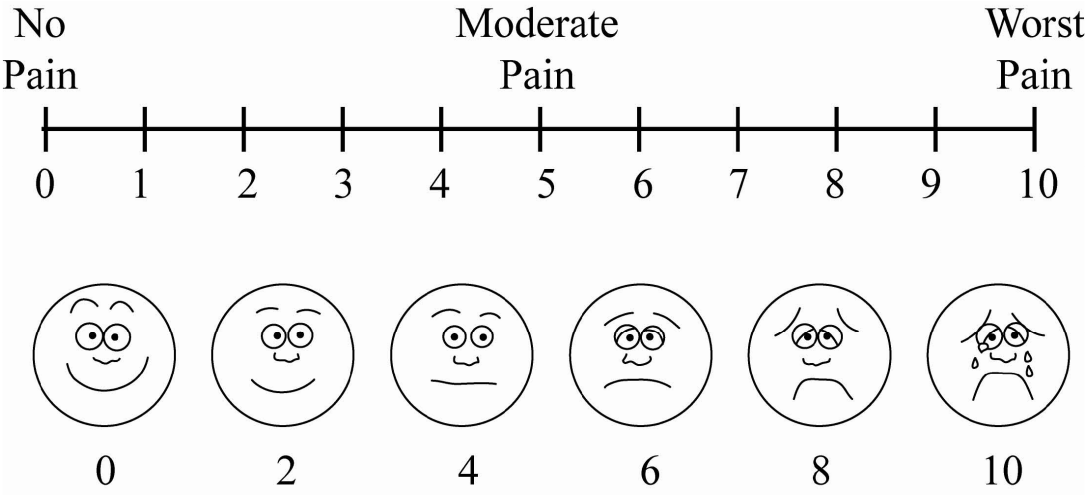
VAS AFTER 12 HOURS:



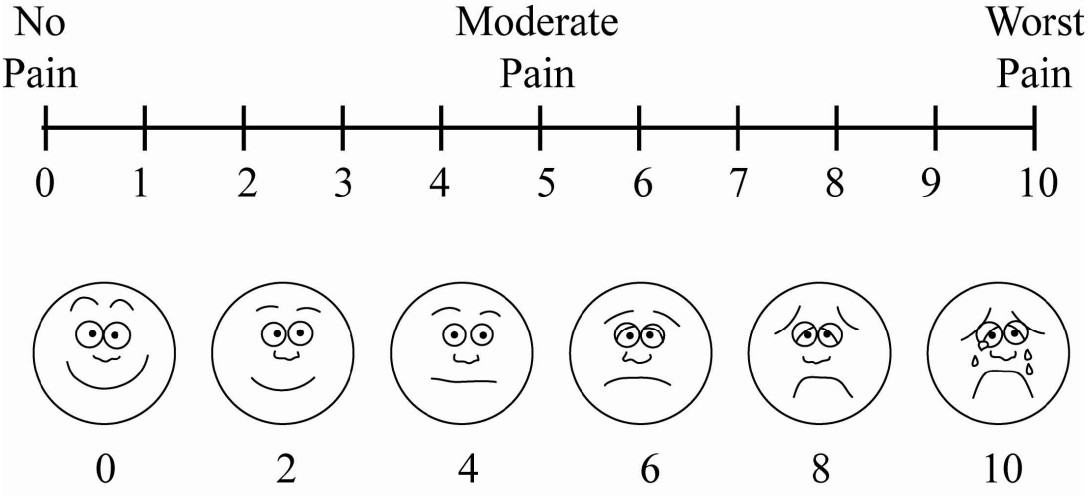
VAS AFTER 24 HOURS:



VAS AFTER 48 HOURS:



VAS AFTER 3 MONTHS:



ASSESSMENT OF POST OPERATIVE WOUND

Southampton Wound Scoring System

- **POD-3**

GRADE 0 Nonnal Healing

GRADE I Normal Healing with mild bruising or erythema

A Some brulsing

B Considerable bruising

C Mild erythema

GRADE II Brythema plus other signs of inflammation

A At one point

B Around sutures

C Along wound

D Around wound

GRADE III Clear or Haemoserous discharge

A At one point only(<20m)

B. Along wound (>2cm)

C Large volume

D Prolonged (>3days)

GRADE IV Pus

A At one point only (<2cm)

B Along wound (>2cm)

GRADE V Deep or severe wound infection with or without tissue breakdown; hematoma requiring aspiration

POD-10

GRADE 0 Nonnal Healing

GRADE I Normal Healing with mild bruising or erythema

A Some brulsing

B Considerable bruising

C Mild erythema

GRADE II Brythema plus other signs of inflammation

A At one point

B Around sutures

C Along wound

D Around wound

GRADE III Clear or Haemoserous discharge

A At one point only(<20m)

B. Along wound (>2cm)

C Large volume

D Prolonged (>3days)

GRADE IV Pus

A At one point only (<2cm)

B Along wound (>2cm)

GRADE V Deep or severe wound infection with or without tissue breakdown; hematoma requiring aspiration

S.No	Unique Patient ID	Age	Gender	Weight (Kg)	Prolene vs PDS	Hemoglobin	Total Protein	Albumin	Duration_of_surgery (minutes)	VAS - 12hr	VAS - 24hr	VAS - 48hr	VAS_3months	South-Hampton score POD-3	South-Hampton score POD-10	Surgery done	Knot Palpable
1	BN36543020	31	F	69	PDS	10.1	7.4	3.2	90.00	4	4	3	0.00	0	0	Laparoscopic cholecystectomy	-
2	SK24072020	20	F	62	PDS	12	7.8	3.6	55.00	3	4	2	0.00	1A	0	Laparoscopic Appendicetomy	-
3	MS08970111	40	M	44	Prolene	15.3	7.9	4.8	45.00	4	8	8	5.00	0	1B	Diagnostic Laparoscopy	-
4	AK52480010	21	M	62	PDS	14.4	7.2	4.6	57.00	3	4	1	0.00	0	1B	Laparoscopic Appendicetomy	-
5	NS76017010	48	M	78	PDS	14	7.8	4.4	70.00	4	7	6	0.00	1A	1C	Laparoscopic cholecystectomy	-
6	MP73140021	60	F	70	Prolene	13.2	7	4.3	60.00	3	6	5	0.00	3A	2A	Laparoscopic cholecystectomy	-
7	GB65237021	60	F	58	Prolene	14.1	6.3	1.6	60.00	4	5	5	0.00	0	2A	Laparoscopic cholecystectomy	-
8	SN35900110	48	F	70	PDS	11.6	6.4	4.3	90.00	5	2	2	4.00	0	0	Laparoscopic cholecystectomy	-
9	RA75357011	40	M	74	Prolene	14.2	8	4.2	62.00	4	5	4	0.00	2C	3A	Laparoscopic Appendicetomy	+
10	SP91367021	51	F	55	Prolene	13.7	7	4.8	60.00	4	6	3	0.00	2D	0	Laparoscopic cholecystectomy	-
11	MT64967021	27	F	67	Prolene	13.6	7.4	4.2	62.00	5	6	5	0.00	2A	0	Laparoscopic Appendicetomy	+
12	VM62187011	27	M	64	Prolene	12.6	7.1	4.7	60.00	4	6	4	0.00	3A	0	Laparoscopic Appendicetomy	-
13	RG02356010	50	M	73	PDS	16.1	6.5	4.4	70.00	4	2	1	0.00	3A	0	Laparoscopic cholecystectomy	-
14	SB40796010	22	M	60	PDS	15.2	7.4	5	56.00	5	3	1	0.00	0	0	Laparoscopic Appendicetomy	-
15	HH47796020	19	F	50	PDS	12.6	6.8	4.7	58.00	3	3	2	0.00	0	0	Laparoscopic Appendicetomy	-
16	SS56677020	50	F	66	PDS	13	7.9	4.4	60.00	5	3	2	0.00	1A	0	Laparoscopic cholecystectomy	-
17	MP84286011	30	M	76	Prolene	14	6.8	4.2	60.00	5	5	3	3.00	3A	2B	Laparoscopic Appendicetomy	-
18	SS24286011	46	M	68	Prolene	15.9	7.7	4.8	60.00	5	5	4	0.00	2D	0	Laparoscopic cholecystectomy	+
19	KD58917011	18	M	70	Prolene	14.8	6.4	4.4	60.00	6	6	6	3.00	0	0	Laparoscopic Appendicetomy	-
20	NB23738011	38	M	69	Prolene	14.5	8.1	4	60.00	4	5	4	0.00	0	0	Laparoscopic cholecystectomy	-
21	FA70418010	38	M	72	PDS	14.8	7.5	5	68.00	5	8	7	0.00	0	0	Laparoscopic cholecystectomy	+
22	SS23458020	34	F	68	PDS	12	7.3	4	69.00	5	3	2	2.00	0	0	Laparoscopic cholecystectomy	-
23	MB82068021	28	F	74	Prolene	11.9	7.1	4.1	60.00	5	7	5	0.00	0	0	Laparoscopic Appendicetomy	-

24	SA50888020	33	F	61	PDS	11.7	6.7	4.3	90.00	5	3	2	0.00	1B	0	Laparoscopic cholecystectomy	-
25	PS31678021	30	F	68	Prolene	11.8	7.6	4.5	60.00	4	5	5	0.00	0	0	Laparoscopic cholecystectomy	-
26	SG49729011	22	M	68	Prolene	14	7.5	4.6	70.00	4	4	3	0.00	1A	0	Laparoscopic Appendicetomy	-
27	SN35900120	48	F	65	PDS	11.6	6.4	4.3	90.00	5	4	1	0.00	0	0	Laparoscopic cholecystectomy	-
28	MK26309011	28	M	78	Prolene	12.1	6.7	4	60.00	4	5	5	0.00	0	0	Laparoscopic Appendicetomy	-
29	MM62421010	40	M	72	PDS	12.6	7.9	4.8	62.00	5	2	2	0.00	0	0	Laparoscopic Appendicetomy	-
30	VM73422110	36	M	50	PDS	15.1	6.8	4	59.00	5	4	2	0.00	1A	0	Laparoscopic Appendicetomy	-
31	AA69522110	26	M	70	PDS	15.3	7.6	4.2	60.00	5	3	1	0.00	0	0	Laparoscopic cholecystectomy	-
32	SL96837021	41	F	62	Prolene	11.6	7.1	4.3	68.00	5	7	7	0.00	0	0	Laparoscopic Appendicetomy	-
33	SK91367021	51	F	60	Prolene	13.7	7	4.6	45.00	7	8	6	3.00	3B	0	Laparoscopic cholecystectomy	-
34	DP30226011	40	M	84	Prolene	13.8	7	4.4	60.00	5	4	7	0.00	1B	0	Laparoscopic Appendicetomy	+
35	PB70018011	23	F	52	Prolene	13	7.6	4.2	60.00	5	7	5	0.00	2A	0	Laparoscopic Appendicetomy	-
36	RB21638021	23	F	58	Prolene	11.6	7.4	3.4	90.00	5	4	8	4.00	2C	0	Laparoscopic Appendicetomy	-
37	SD06368021	25	F	56	Prolene	11.1	6.6	3.2	60.00	5	5	6	0.00	0	0	Laparoscopic cholecystectomy	-
38	MR50616020	33	F	60	PDS	13.8	8	4.9	60.00	3	7	6	0.00	2C	0	Laparoscopic Appendicetomy	-
39	RJ34167020	52	M	80	PDS	13.6	7.4	4.4	60.00	4	4	2	0.00	0	0	Laparoscopic Appendicetomy	+
40	PP48426010	18	M	50	PDS	14.3	6.8	2.1	60.00	5	6	3	0.00	1C	1A	Laparoscopic Appendicetomy	-
41	SS75844010	57	M	72	PDS	12	6.7	3.5	70.00	5	4	2	4.00	0	1B	Laparoscopic cholecystectomy	-
42	SB40037020	36	F	48	PDS	12.3	7.7	4.7	52.00	5	8	7	0.00	0	0	Laparoscopic Appendicetomy	-
43	PM19037020	20	F	64	PDS	11.1	6.8	4.4	60.00	5	3	1	0.00	2A	2A	Laparoscopic Appendicetomy	-
44	AR87847020	25	F	75	PDS	13.7	7.9	4.9	58.00	5	5	2	3.00	0	2A	Laparoscopic Appendicetomy	-
45	SH45667020	24	F	64	PDS	12.5	8.2	4.8	60.00	4	6	4	0.00	0	0	Laparoscopic Appendicetomy	-
46	NS12816011	30	M	72	Prolene	14.2	7.2	4.7	30.00	3	6	6	0.00	0	0	Laparoscopic Appendicetomy	-
47	CS83609121	34	F	57	Prolene	13.7	8.2	5.2	40.00	4	6	7	3.00	1C	0	Laparoscopic cholecystectomy	-

48	SV41541021	28	F	55	Prolene	10.1	7.2	4.9	70.00	4	4	3	0.00	1A	3B	Laparoscopic Appendicetomy	-
49	AY44735021	29	F	58	Prolene	12	6.6	4.4	86.00	5	5	6	3.00	0	0	Laparoscopic cholecystectomy	-
50	NN64532021	42	F	62	Prolene	9	7.1	4.2	90.00	5	5	5	0.00	0	2C	Laparoscopic Appendicetomy	+
51	AR99413011	25	M	78	Prolene	12.6	6.4	3.1	60.00	5	5	6	0.00	1C	1C	Laparoscopic Appendicetomy	-
52	BE32323011	41	M	72	Prolene	11.8	7.5	3.2	90.00	5	8	7	0.00	0	0	Laparoscopic Appendicetomy	+
53	RN57994011	51	M	68	Prolene	15.5	8	4.9	105.00	3	5	2	0.00	0	0	Laparoscopic cholecystectomy	-
54	MD30641021	44	F	76	Prolene	10.2	7	4.2	75.00	5	4	5	0.00	1A	1A	Laparoscopic cholecystectomy	-
55	SM26767020	39	F	70	PDS	12.4			90.00	3	6	6	0.00	0	0	Laparoscopic cholecystectomy	-
56	MK44068020	22	F	68	PDS	10.9	6.5	4.2	60.00	5	4	3	0.00	0	0	Laparoscopic Appendicetomy	-
57	MM82068020	28	F	60	PDS	12	6.9	3.7	90.00	5	6	7	0.00	2A	0	Laparoscopic Appendicetomy	-
58	MO18287010	22	M	80	PDS	14.6	7.3	3.6	60.00	5	6	7	0.00	0	0	Laparoscopic Appendicetomy	+
59	RD90258010	22	M	72	PDS	15.8	6.8	3.4	60.00	4	3	2	0.00	3B	3A	Laparoscopic Appendicetomy	-
60	PG06513020	45	F	66	PDS	12.7	6.8	3.9	60.00	4	3	1	0.00	0	0	Laparoscopic Appendicetomy	-
61	SM84653020	60	F	67	PDS	12.8	6.7	4.4	60.00	5	3	2	0.00	1A	0	Laparoscopic cholecystectomy	-
62	SK27567010	48	M	78	PDS	12.8	8	4.9	60.00	4	6	3	0.00	0	0	Laparoscopic Appendicetomy	-
63	KR39170011	43	M	78	Prolene	14	7.9	4.8	72.00	5	5	4	0.00	1A	1A	Laparoscopic Appendicetomy	-
64	MB24256011	48	M	69	Prolene	14.1	7.8	4.1	85.00	5	5	6	0.00	0	0	Laparoscopic cholecystectomy	+
65	AK24256011	25	F	60	Prolene	14.8	7.8	3.5	120.00	5	7	7	3.00	0	0	Laparoscopic cholecystectomy	-
66	SW78177021	33	F	72	Prolene	14.2	8	4.3	90.00	5	4	7	3.00	0	0	Laparoscopic cholecystectomy+Adhesiolysis	-
67	SA29985020	25	F	48	PDS	11.6			70.00	5	4	2	0.00	2C	2C	Laparoscopic cholecystectomy	+
68	MS51106020	52	M	71	PDS	10.7	6.1	3.8	49.00	3	6	6	0.00	3A	0	Laparoscopic Appendicetomy	-
69	NA62306020	41	F	55	PDS	12	7.1	4.6	75.00	3	4	2	0.00	0	0	Laparoscopic cholecystectomy	-
70	MT57116020	29	F	53	PDS	12.6	6.2	4.1	55.00	5	4	1	0.00	1B	0	Laparoscopic cholecystectomy	-
71	DP30226011	40	M	62	Prolene	13.8	7	4.4	45.00	5	5	5	3.00	0	0	Laparoscopic Appendicetomy	-

72	LA98716021	49	F	68	prolene	11	7.1	3.8	85.00	4	4	3	0.00	0	0	Laparoscopic cholecystectomy	-
73	KM05486011	45	M	76	Prolene	14	7.1	4.4	60.00	5	5	3	0.00	1C	0	Laparoscopic cholecystectomy	+
74	SB31486010	45	M	68	PDS	16.3	7	4.6	120.00	4	3	2	0.00	0	0	Laparoscopic cholecystectomy	-
75	ND20817020	20	F	51	PDS	12.2	7.6	4.7	70.00	5	4	3	0.00	0	0	Laparoscopic Appendicetomy	-
76	SB40037021	36	F	58	Prolene	12.3	7.7	4.7	80.00	4	5	5	0.00	0	0	Laparoscopic Appendicetomy	-
77	AM26547020	27	F	63	PDS	12.7	7.5	4.7	50.00	5	6	6	0.00	2B	0	Laparoscopic cholecystectomy	-
78	ST17457011	40	M	70	Prolene	13.9	6.7	4.6	45.00	4	5	3	0.00	0	0	Laparoscopic Appendicetomy	-