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Sequential Camera Exchange Technique (SCET) in Modified Three-Port Laparoscopic Cholecystectomy Using a Concealed Suprapubic Port: A Technical Report with Case Illustration

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Abstract: ***Background**: Laparoscopic cholecystectomy is the gold standard treatment for symptomatic gallstone disease. Although the conventional four-port technique remains widely practiced, ongoing efforts to further reduce surgical trauma and improve cosmetic outcomes have led to the development of various reduced-port approaches. However, many of these techniques compromise instrument ergonomics or require advanced laparoscopic expertise. We describe a modified three-port laparoscopic cholecystectomy utilizing a concealed suprapubic working port and a low right iliac working port that preserves triangulation while minimizing visible abdominal scars. **Case Presentation**: A 21-year-old female (BMI 16.2 kg/m²) presented with intermittent right upper abdominal pain for one year. Ultrasonography demonstrated multiple gallbladder calculi measuring approximately 4.7 mm with posterior acoustic shadowing, while the gallbladder wall and common bile duct were normal. Routine laboratory investigations were within normal limits. A modified three-port laparoscopic cholecystectomy incorporating a Sequential Camera Exchange Technique (SCET) was performed using two 5-mm ports and one concealed 10-mm suprapubic port. The procedure was completed successfully in 72 minutes with an estimated blood loss of 20 mL. The Critical View of Safety was achieved without the need for additional ports or conversion to open surgery. Postoperative recovery was uneventful, with Visual Analogue Scale (VAS) pain scores of 4 at 6 hours and 2 on postoperative day one, and the patient was discharged on postoperative day one with excellent cosmetic satisfaction. **Conclusion**: This modified three-port laparoscopic cholecystectomy technique appears to be a safe, feasible, and cosmetically favorable alternative to the conventional four-port approach in carefully selected patients. By relocating the principal working port to the concealed suprapubic region while maintaining a low right iliac working port, the technique preserves operative ergonomics, facilitates safe dissection of Calot's triangle, and achieves excellent cosmetic results. Larger prospective comparative studies are required to evaluate its reproducibility, safety, and long-term clinical outcomes.*

Keywords: Cholecystectomy, Laparoscopic; Cholelithiasis; Minimally Invasive Surgical Procedures; Reduced-Port Surgery; Suprapubic Port; Cosmetic Outcome; Surgical Innovation; Three-Port Laparoscopy

1. Introduction

Gallstone disease is one of the most common gastrointestinal disorders worldwide, affecting approximately 10–15% of the adult population and representing a major indication for elective abdominal surgery.[1–3] Symptomatic cholelithiasis may manifest as biliary colic, acute or chronic cholecystitis, choledocholithiasis, pancreatitis, or other biliary complications that frequently require surgical intervention.[2,3] Since its introduction by **Philippe Mouret** in 1987, laparoscopic cholecystectomy has become the gold standard for the treatment of symptomatic gallstone disease because of its well-established advantages over open surgery, including reduced postoperative pain, shorter hospital stay, earlier return to normal activities, and improved cosmetic outcomes.[4–6]

The conventional laparoscopic cholecystectomy technique utilizes four ports to achieve adequate triangulation, optimal visualization of Calot's triangle, and safe dissection according to the principles of the **Critical View of Safety (CVS)**.[6–8] Although this approach has demonstrated excellent safety and reproducibility, increasing emphasis on minimally invasive surgery has stimulated the development of reduced-port techniques aimed at minimizing abdominal wall trauma and improving cosmetic results without compromising operative safety.[8,9]

Among these innovations, **three-port laparoscopic cholecystectomy** has been shown in several randomized trials and meta-analyses to provide outcomes comparable to the conventional four-port approach, with potential reductions in postoperative pain, analgesic requirements, and improved patient satisfaction.[10–14] Nevertheless, considerable heterogeneity exists in the reported port configurations, camera positions, and operative workflows, limiting widespread adoption and reproducibility. Furthermore, many modifications compromise ergonomic instrument handling

or require changes in the surgeon's operating position, thereby increasing the learning curve.

Single-incision laparoscopic surgery (SILS) and natural orifice transluminal endoscopic surgery (NOTES) have been proposed as further refinements to minimize visible scarring. However, these techniques frequently require specialized instruments, suffer from instrument crowding and loss of triangulation, and are associated with a steeper learning curve and increased procedural complexity, limiting their routine clinical application.[15,16]

The **Critical View of Safety**, first described by Strasberg, remains the cornerstone of safe laparoscopic cholecystectomy and should not be compromised by any reduced-port modification.[7,8,17] Consequently, any technical innovation should aim to preserve established safety principles while improving ergonomics and cosmetic outcomes.

To address these limitations, we developed a standardized **Sequential Camera Exchange Technique (SCET)** using a concealed **10-mm suprapubic port**, a **5-mm umbilical port**, and a **5-mm right iliac fossa working port**. By alternating the laparoscope between the umbilical and suprapubic ports during specific stages of the operation, this technique preserves triangulation, facilitates safe dissection of Calot's triangle, enables specimen retrieval through a concealed incision, and maintains the principles of the Critical View of Safety using only conventional laparoscopic instruments.

To our knowledge, this is the first report describing a **standardized Sequential Camera Exchange Technique (SCET)** integrated into a modified three-port laparoscopic cholecystectomy using a concealed suprapubic working port. We present the operative technique, its anatomical rationale, and its successful application in an illustrative clinical case.

Surgical Anatomy and Rationale

Successful laparoscopic cholecystectomy depends on precise anatomical orientation, adequate instrument triangulation, and consistent visualization of the hepatocystic triangle to achieve the **Critical View of Safety (CVS)**.[7,8,17] The gallbladder lies in the gallbladder fossa on the visceral surface of the liver, where it is connected to the biliary tree through the cystic duct and receives its arterial supply predominantly from the cystic artery, usually arising from the right hepatic artery. Considerable anatomical variations of the cystic duct, cystic artery, and extrahepatic biliary tree are well recognized and contribute significantly to the risk of bile duct injury during laparoscopic cholecystectomy.[3,7,17] Consequently, meticulous exposure of Calot's triangle and attainment of the Critical View of Safety remain the most reliable strategies for preventing biliary and vascular injury.

The conventional four-port technique provides excellent ergonomics by establishing a stable triangulation between the camera and two working instruments. However, one of the upper abdominal ports contributes little to dissection once adequate retraction has been established and primarily serves as an auxiliary access point. Several reduced-port techniques have therefore attempted to eliminate this incision while preserving operative safety.[10–14] Although many three-port modifications have demonstrated comparable clinical outcomes, differences in port placement and camera positioning often alter instrument geometry, reduce ergonomics, or compromise visualization during critical stages of dissection.

The present technique was designed to preserve the familiar ergonomics of conventional laparoscopic cholecystectomy while improving cosmetic outcomes through strategic relocation of the 10-mm working port to the **suprapubic region**, where the scar remains concealed beneath normal clothing. The port configuration consists of a **5-mm umbilical port**, a **10-mm suprapubic port**, and a **5-mm right iliac fossa working port** positioned along the line joining the anterior superior iliac spine and pubic symphysis, approximately **4 cm medial to the anterior superior iliac spine**. This arrangement maintains effective triangulation while avoiding additional upper abdominal scars.

The key innovation of this approach is the **Sequential Camera Exchange Technique (SCET)**, in which the laparoscope is alternated between the umbilical and suprapubic ports according to the requirements of each operative stage. Initial abdominal access and placement of the remaining trocars are performed using a **5-mm laparoscope introduced through the umbilical port**. Following trocar placement, a **10-mm laparoscope** is transferred to the suprapubic port to provide a direct inferior view of Calot's triangle during dissection. Once the Critical View of Safety has been achieved, the camera is returned to the umbilical port, allowing the **10-mm suprapubic port** to accommodate standard clip applicators for secure clipping and division of the cystic duct and cystic artery. The laparoscope is subsequently repositioned to the suprapubic port for inspection of the gallbladder bed and retrieval of the specimen through the concealed suprapubic incision.

This sequential exchange preserves the familiar principles of triangulation while exploiting the advantages of two complementary viewing angles. The inferior suprapubic perspective facilitates precise dissection within Calot's triangle and visualization of the cystic pedicle, whereas the umbilical perspective permits conventional clip application without requiring specialized instruments or additional trocars. Throughout the procedure, the principles of the **Critical View of Safety** are maintained, ensuring that complete circumferential identification of the cystic duct and cystic artery is achieved before division.[7,8,17]

Unlike single-incision laparoscopic surgery and other advanced reduced-port techniques, this modification requires **no specialized ports, articulating instruments, flexible laparoscopes, or additional disposable devices**.[15,16] Instead, it utilizes standard laparoscopic equipment while preserving surgeon ergonomics, minimizing instrument crowding, and maintaining reproducibility. Consequently, the technique may offer a practical transition from conventional four-port laparoscopic cholecystectomy to reduced-port surgery without substantially increasing technical complexity or compromising established safety principles.

2. Case Presentation

A **21-year-old woman** presented to the Department of General Surgery, Ganesh Shankar Vidyarthi Memorial (GSVM) Medical College, Kanpur, with a **one-year history of intermittent right upper quadrant abdominal pain**. The pain was episodic, dull aching in nature, and occasionally exacerbated after meals. There was no history of fever, jaundice, vomiting, acute pancreatitis, or previous episodes of acute cholecystitis. Her medical history was unremarkable, with **no comorbid illnesses, previous abdominal surgeries, or regular medication use**.

On physical examination, the patient was **underweight**, with a **body mass index (BMI) of 16.2 kg/m²**. She was afebrile and hemodynamically stable. Abdominal examination revealed mild tenderness in the right hypochondrium without guarding, rigidity, palpable mass, or hepatomegaly. Murphy's sign was negative, and the remainder of the systemic examination was unremarkable.

Routine laboratory investigations, including complete blood count, liver function tests, renal function tests, coagulation profile, and serum electrolytes, were within normal limits. Hemoglobin was **12.8 g/dL**, total leukocyte count **7,000/mm³**, platelet count **1.46 × 10⁵/mm³**, serum bilirubin **0.58 mg/dL**, serum creatinine **0.68 mg/dL**, and liver enzyme levels were within the normal reference range. These findings suggested uncomplicated symptomatic cholelithiasis without evidence of biliary obstruction or active infection.

Ultrasonography of the abdomen demonstrated **multiple gallstones with an average diameter of 4.7 mm producing posterior acoustic shadowing**. The gallbladder wall thickness was within normal limits, and there was **no pericholecystic fluid, biliary dilatation, or common bile duct abnormality**. Based on the clinical presentation and ultrasonographic findings, a diagnosis of **symptomatic chronic calculous cholecystitis** was established, and the patient was scheduled for elective laparoscopic cholecystectomy.

After detailed counselling regarding the modified three-port approach and the Sequential Camera Exchange Technique (SCET), written informed consent was obtained. The procedure was performed on **27 May 2026** by **Prof. (Dr.) Sanjay Kala** using the standardized technique described above. The total operative time was **72 minutes**, with an estimated blood loss of approximately **20 mL**. No additional ports were required, and there was **no conversion to conventional four-port laparoscopy or open cholecystectomy**.

Intraoperative findings revealed a **mildly thickened gallbladder** containing **multiple small black pigmented calculi**. Calot's triangle was free of significant fatty tissue, allowing clear identification of the cystic duct and cystic artery. The **Critical View of Safety** was achieved before clipping and division of the cystic structures. The gallbladder was dissected uneventfully from the liver bed and retrieved intact through the concealed **10-mm suprapubic port**.

Histopathological examination demonstrated **chronic cholecystitis with cholelithiasis**. Gross examination revealed a gallbladder measuring **6.5 × 1.5 × 1.0 cm** containing multiple calculi. Microscopic evaluation showed **partially denuded mucosa, Rokitansky–Aschoff sinuses, focal pyloric gland metaplasia, and chronic transmural inflammatory infiltrates composed predominantly of lymphocytes and macrophages**, without evidence of dysplasia or malignancy. Fourier-transform infrared (FTIR) analysis of the gallstones demonstrated a composition of **30% fibrin, 30% mucin, 20% biliverdin, and 20% hematin**, consistent with **black pigment calculi**.

The postoperative course was uneventful. Pain assessment using the **Visual Analogue Scale (VAS)** demonstrated a score of **4 at 6 hours** postoperatively, improving to **2 on postoperative day one**. Oral intake was resumed on the day of surgery, and the patient was mobilized early according to Enhanced Recovery After Surgery (ERAS) principles.[18,19] She was discharged in stable condition on the **first postoperative day**.

At follow-up, all wounds had healed satisfactorily without evidence of surgical-site infection, port-site hernia, or other postoperative complications. The concealed suprapubic incision produced an excellent cosmetic result, with the patient expressing high satisfaction regarding both the aesthetic appearance and the overall surgical outcome.

Operative Technique

After induction of general anesthesia, the patient was positioned supine with both arms tucked alongside the body. Following sterile skin preparation and draping, the operating surgeon stood on the patient's left side with the camera assistant positioned to the left of the surgeon, while the monitor was placed near the patient's right shoulder to maintain an ergonomic line of sight throughout the procedure.

Pneumoperitoneum was established using the **open (Hasson) technique** through a **5-mm transumbilical port**, after which a **5-mm laparoscope** was introduced to perform diagnostic laparoscopy and facilitate safe placement of the remaining trocars under direct vision. A **10-mm suprapubic port** was inserted in the midline immediately superior to the pubic symphysis, and a **5-mm right iliac fossa working port** was placed along the line joining the anterior superior iliac spine and the pubic symphysis, approximately **4 cm medial to the anterior superior iliac spine** (Figure 1).

Following trocar placement, the procedure was performed according to the **Sequential Camera Exchange Technique (SCET)**. Initially, the laparoscope remained in the umbilical port during abdominal access and trocar placement. Thereafter, a **10-mm laparoscope was transferred to the suprapubic port**, providing a direct inferior view of the hepatocystic triangle. This viewing angle improved visualization of Calot's triangle while preserving conventional triangulation and comfortable instrument ergonomics.

The gallbladder fundus was grasped through the right iliac fossa port and retracted cephalad towards the patient's right

shoulder. Gentle lateral traction on Hartmann's pouch exposed the hepatocystic triangle. Using a Maryland dissector and monopolar hook electrocautery introduced through the umbilical port, the peritoneal reflections overlying Calot's triangle were incised anteriorly and posteriorly. Careful blunt and sharp dissection was continued to skeletonize the cystic duct and cystic artery while partially separating the lower one-third of the gallbladder from the liver bed.

Dissection proceeded until the **Critical View of Safety (CVS)** was unequivocally established according to Strasberg's criteria by fulfilling all three essential components: (1) complete clearance of the hepatocystic triangle of fibrofatty tissue, (2) separation of the lower one-third of the gallbladder from the liver bed to expose the cystic plate, and (3) visualization of only two structures entering the gallbladder—the cystic duct and cystic artery—before clipping or division (Figure 2).[7,8,17]

Once the Critical View of Safety had been confirmed, the laparoscope was **exchanged back to the 5-mm umbilical port**, thereby freeing the **10-mm suprapubic port** for introduction of a standard laparoscopic clip applicator. The cystic artery and cystic duct were sequentially secured with titanium clips and divided in the conventional manner while maintaining uninterrupted visualization through the umbilical camera. This camera exchange represents the key innovation of the SCET workflow, allowing standard clip application without compromising ergonomics or requiring additional trocars.

Following division of the cystic pedicle, the **10-mm laparoscope was reintroduced through the suprapubic port** to optimize visualization during dissection of the gallbladder from the hepatic fossa using monopolar electrocautery. Continuous cephalad traction through the right iliac fossa grasper facilitated precise separation from the liver bed. Meticulous hemostasis was achieved, and careful inspection confirmed the absence of bile leakage or vascular bleeding.

The gallbladder, containing multiple small black pigment calculi, was retrieved intact through the concealed **10-mm suprapubic port** without enlargement of any incision (Figure 3). The operative field was irrigated with normal saline and reinspected under direct vision before controlled evacuation of pneumoperitoneum.

The fascial defect at the **10-mm suprapubic port** was closed with **2-0 polyglactin (Vicryl)** sutures, while all skin incisions were approximated using **3-0 nylon** sutures. No drain was placed. The procedure was completed successfully without the need for additional trocar placement, conversion to conventional four-port laparoscopic cholecystectomy, or conversion to open surgery.

Figure 1: Port configuration demonstrating the Sequential Camera Exchange Technique (SCET). A 5-mm umbilical port was used for initial access and alternate camera placement, a concealed 10-mm suprapubic port served for camera exchange, clip application, and specimen retrieval, and a 5-mm right iliac fossa port functioned as the working/retraction port.

Figure 2: Critical View of Safety after clipping of the cystic duct (yellow staining at the transected duct) with the cystic artery clearly identified prior to division.

Figure 3: Retrieved specimen of gall bladder with stones

Table 1: Sequential Camera Exchange Technique (SCET) Workflow

Operative Stage	Camera Position	Primary Purpose
Initial access	5-mm umbilical	Diagnostic laparoscopy and trocar placement
Calot's triangle dissection	10-mm suprapubic	Direct inferior visualization of hepatocystic triangle
Clip application	5-mm umbilical	Frees suprapubic port for 10-mm clip applicator
Gallbladder bed inspection and specimen retrieval	10-mm suprapubic	Inferior visualization and concealed specimen extraction

Technical Pearls

- Establish pneumoperitoneum through a **5-mm umbilical port** using the open (Hasson) technique.
- Insert the remaining ports under direct laparoscopic vision.
- Use the **5-mm laparoscope** for initial access and trocar placement.
- Transfer the **10-mm laparoscope** to the suprapubic port for dissection of Calot's triangle.
- Return the **5-mm camera** to the umbilical port before introducing the **10-mm clip applicator** through the suprapubic port.
- Reintroduce the **10-mm laparoscope** into the suprapubic port during gallbladder bed dissection and specimen retrieval.
- Confirm all three components of the **Critical View of Safety** before clipping or dividing any biliary structure.[7, 8, 17]
- Retrieve the specimen through the concealed suprapubic incision to optimize cosmetic outcomes.
- If visualization or exposure becomes inadequate, place an additional port without hesitation; reduced-port surgery should never compromise patient safety.

Postoperative Management and Follow-up

Following surgery, the patient was transferred to the postoperative recovery unit in a hemodynamically stable condition. Standard postoperative monitoring, including continuous assessment of vital parameters, urine output, and pain, was carried out according to institutional protocol. Intravenous fluids, prophylactic antibiotics, and multimodal analgesia were administered during the immediate postoperative period.

An Enhanced Recovery After Surgery (ERAS)-based postoperative pathway was followed. Oral sips of water were initiated approximately **six hours** after surgery, followed by gradual advancement to a soft oral diet as tolerated. Early ambulation was encouraged on the day of surgery, and the patient was mobilized without difficulty. No postoperative nausea, vomiting, fever, respiratory complications, urinary retention, or other early postoperative events were observed.

Postoperative pain was assessed using the **Visual Analogue Scale (VAS)**. The patient reported a **VAS score of 4/10 at six hours postoperatively**, which improved to **2/10 on postoperative day one** with routine analgesic therapy consisting of non-opioid analgesics. No rescue opioid analgesia was required during the hospital stay.

The postoperative course remained uneventful. Clinical examination revealed no evidence of bile leak, intra-abdominal collection, surgical site infection, port-site hematoma, seroma, or hemorrhage. The patient tolerated oral feeding well, remained ambulant, and demonstrated satisfactory recovery without any procedure-related complications.

The patient was discharged in a stable condition on **postoperative day one** with instructions regarding wound care, dietary modification, gradual return to normal physical activity, and scheduled outpatient follow-up.

Histopathological examination of the excised gallbladder confirmed **chronic cholecystitis with cholelithiasis**. Gross examination demonstrated a gallbladder measuring **6.5 × 1.5 × 1.0 cm** containing multiple gallstones. Microscopic examination revealed chronic inflammatory changes characterized by partially denuded mucosa, Rokitansky–Aschoff sinuses, focal pyloric gland metaplasia, transmural lymphocytic and macrophage infiltration, and congested blood vessels, without evidence of dysplasia or malignancy.

Fourier-transform infrared (FTIR) analysis of the extracted gallstones revealed a composition of **fibrin (30%)**, **mucin (30%)**, **biliverdin (20%)**, and **hematin (20%)**, consistent with **black pigment gallstones**.

At follow-up, the patient exhibited satisfactory wound healing without evidence of surgical site infection, incisional hernia, or delayed wound complications. All port-site incisions had healed well. The **5-mm umbilical incision** remained concealed within the natural umbilical fold, while the **10-mm suprapubic incision** was completely hidden beneath the bikini line. The **5-mm right iliac fossa incision** was minimally visible and cosmetically acceptable. The patient expressed a high level of satisfaction with the postoperative cosmetic outcome and reported an early return to routine daily activities without functional limitation.

No readmissions, re-interventions, or delayed postoperative complications were recorded during the follow-up period.

Outcome Summary

Parameter	Outcome
Operative time	72 minutes
Estimated blood loss	Approximately 20 mL
Additional ports	None
Conversion to open surgery	None
VAS pain score (6 hours)	04-10
VAS pain score (Postoperative Day 1)	02-10
Oral intake	Initiated at 6 hours
Ambulation	Same day
Hospital stay	1 day
Early complications	None
Wound infection	None
Bile leak	None
Readmission	None
Cosmetic satisfaction	Excellent

3. Discussion

Laparoscopic cholecystectomy has remained the gold standard for the management of symptomatic gallstone disease for more than three decades because of its well-established advantages over open surgery, including reduced postoperative pain, shorter hospitalization, faster recovery, and superior cosmetic outcomes.[4–6] Although the conventional four-port technique continues to provide excellent safety and reproducibility, increasing patient expectations regarding cosmesis and minimally invasive surgery have stimulated the development of reduced-port approaches.[10–16]

Numerous modifications of three-port laparoscopic cholecystectomy have been described, differing in port placement, camera position, and surgeon ergonomics.[10–14] Randomized controlled trials and systematic reviews have demonstrated that three-port techniques can achieve operative outcomes comparable to the conventional four-port approach while potentially reducing postoperative pain and improving cosmetic satisfaction.[13,14] However, most reported techniques modify only the **number or location of ports** and do not provide a standardized intraoperative workflow. Consequently, many remain technically demanding, are difficult to reproduce consistently, or compromise optimal triangulation during critical stages of dissection.

The present technique differs from previously described modifications by introducing a **standardized Sequential Camera Exchange Technique (SCET)** rather than relying solely on an alternative port configuration. Instead of maintaining a fixed camera position throughout the operation, the laparoscope is intentionally exchanged between the umbilical and suprapubic ports according to the specific requirements of each operative stage. This sequential approach preserves conventional triangulation during dissection, permits ergonomic clip application using standard laparoscopic instruments, and facilitates specimen retrieval through a concealed suprapubic incision without requiring additional trocars or specialized equipment.

Another distinguishing feature of this modification is the placement of the **10-mm suprapubic port**, which serves a dual purpose. In addition to functioning as the principal viewing port during dissection of Calot's triangle, it also permits specimen retrieval through a cosmetically concealed incision. Because the scar lies below the underwear line, the technique minimizes visible upper abdominal scarring while preserving the familiar operating principles of conventional laparoscopic cholecystectomy. Unlike single-incision laparoscopic surgery, which is frequently associated with instrument crowding, loss of triangulation, and increased technical difficulty,[15,16] the present approach maintains comfortable instrument spacing and surgeon ergonomics using standard laparoscopic equipment.

The **Critical View of Safety (CVS)** remains the cornerstone of safe laparoscopic cholecystectomy and is recognized as the most effective strategy for preventing bile duct injury.[7,8,17] Preservation of CVS was considered fundamental throughout the development of the present technique. The sequential camera exchange provides complementary viewing angles during different phases of the operation while ensuring that complete circumferential identification of the cystic duct and cystic artery is achieved before clipping and division. Importantly, the modification alters neither the principles of dissection nor the established sequence required for safe biliary surgery.

The illustrative case demonstrated the technical feasibility of the proposed workflow. Despite using only three ports, the procedure was completed successfully without the need for additional trocar placement or conversion to conventional four-port laparoscopy or open surgery. Operative time (**72 minutes**) and estimated blood loss (**20 mL**) were comparable with those reported for conventional laparoscopic cholecystectomy.[10–14] Histopathological examination confirmed **chronic cholecystitis with cholelithiasis**, correlating with the patient's clinical presentation and ultrasonographic findings. Postoperative pain was modest, with Visual Analogue Scale scores improving from **4 at six hours** to **2 on postoperative day one**, and the patient was discharged on the first postoperative day following an Enhanced Recovery After Surgery (ERAS) pathway.[18,19] The concealed suprapubic incision also produced an excellent cosmetic result, which was highly appreciated by the patient.

Although the present report demonstrates the reproducibility and feasibility of SCET, several limitations should be acknowledged. This is a **single illustrative case**, and conclusions regarding superiority over conventional three-port or four-port laparoscopic cholecystectomy cannot be drawn. Objective assessment of postoperative pain, cosmetic satisfaction, surgeon ergonomics, and quality of life was not performed using validated outcome measures. Furthermore, the technique was evaluated in a patient with uncomplicated chronic calculous cholecystitis; its applicability in acute cholecystitis, obesity, dense adhesions, or other technically challenging situations remains to be established.

Future prospective studies involving larger patient cohorts and comparative analyses with conventional laparoscopic techniques are required to evaluate operative efficiency,

postoperative pain, cosmetic outcomes, surgeon ergonomics, learning curve, and long-term safety. Such studies will determine whether the proposed Sequential Camera Exchange Technique offers measurable clinical advantages while maintaining the high standards of safety expected in modern laparoscopic biliary surgery.

In conclusion, this technical report demonstrates that the **Sequential Camera Exchange Technique** can be successfully integrated into a modified three-port laparoscopic cholecystectomy using a concealed suprapubic working port without compromising the principles of the Critical View of Safety. The technique employs only conventional laparoscopic equipment, preserves ergonomic triangulation, facilitates concealed specimen retrieval, and appears to be a practical and reproducible modification deserving further evaluation in larger clinical studies.

Table 2: Comparison of Three-Port Techniques

Parameter	Conventional 4-Port LC	Standard 3-Port LC	Present SCET Technique
Number of ports	4	3	3
10-mm ports	Umbilical ± epigastric	Variable	Suprapubic only
Camera position	Fixed	Fixed	Sequential exchange
Specimen retrieval	Umbilical	Umbilical	Concealed suprapubic
Specialized equipment	No	No	No
Critical View of Safety	Yes	Yes	Yes
Upper abdominal scars	Three	Two	One

Advantages of the Technique

The proposed **Sequential Camera Exchange Technique (SCET)** offers several practical advantages while preserving the established principles of safe laparoscopic cholecystectomy.

First, the technique **maintains the Critical View of Safety (CVS)** throughout the procedure by preserving adequate triangulation and optimal visualization of the hepatocystic triangle before clipping and division of the cystic duct and cystic artery.[7,8,17]

Second, the **Sequential Camera Exchange Technique** allows the surgeon to exploit two complementary viewing angles during different stages of the operation. The inferior suprapubic perspective facilitates precise dissection within Calot's triangle, whereas the umbilical perspective permits conventional clip application through the 10-mm suprapubic port without compromising ergonomics or requiring additional trocars.

Third, relocating the **10-mm port to the concealed suprapubic region** enables specimen retrieval through an incision that remains hidden beneath normal clothing. This reduces the number of visible upper abdominal scars while maintaining standard laparoscopic principles and may improve cosmetic satisfaction, particularly in young and cosmetically conscious patients.

Another important advantage is that the procedure is performed **entirely with conventional laparoscopic equipment**. Unlike single-incision laparoscopic surgery or other advanced reduced-port techniques, SCET does not require articulating instruments, flexible laparoscopes, specialized access devices, or additional disposable equipment, thereby avoiding increased procedural costs and facilitating wider adoption.[15,16]

The standardized sequence of camera exchanges also contributes to **reproducibility**. Because each stage of the operation follows a predefined workflow, the technique can be consistently reproduced without altering the surgeon's operating position or the fundamental steps of conventional laparoscopic cholecystectomy.

Finally, the present case demonstrated that the technique could be completed safely without additional port placement or conversion to conventional four-port laparoscopy or open surgery, while achieving satisfactory operative time, minimal blood loss, early postoperative recovery, and excellent cosmetic results.

Key Advantages of the Standardized Workflow

- Concealed 10-mm suprapubic incision with improved cosmetic outcome.
- Only two visible 5-mm abdominal scars.
- Preservation of ergonomic triangulation and comfortable instrument handling.
- Sequential Camera Exchange Technique optimizes visualization during different operative stages.
- Standard laparoscopic instruments and trocars; no specialized equipment required.
- Familiar operative principles for surgeons experienced in conventional laparoscopic cholecystectomy.
- Safe specimen retrieval through the concealed suprapubic port.
- Reproducible and suitable for teaching and training.
- Adherence to the Critical View of Safety remains unchanged.
- Potential for broader adoption in resource-limited settings.

4. Limitations

Despite its encouraging technical feasibility, the proposed **Sequential Camera Exchange Technique (SCET)** has several limitations that should be acknowledged.

First, this report describes the application of the technique in **a single illustrative case**, precluding any conclusions regarding superiority over conventional three-port or four-port laparoscopic cholecystectomy. Larger prospective comparative studies are required to establish its safety, reproducibility, and potential clinical benefits.

Second, although the sequential exchange of the laparoscope was technically straightforward in the present case, it introduces an additional operative step that may require a short learning curve for surgeons unfamiliar with the workflow. Familiarity with conventional laparoscopic cholecystectomy and effective coordination between the surgeon and camera assistant are essential for smooth execution of the technique.

Third, the technique was evaluated in a patient with **uncomplicated chronic calculous cholecystitis**. Its applicability in patients with acute cholecystitis, empyema of the gallbladder, Mirizzi syndrome, severe obesity, dense adhesions, or other complex biliary pathology remains to be determined. In such situations, additional ports or conversion to the conventional four-port technique may be necessary to maintain operative safety.

Furthermore, objective assessments of **postoperative pain, cosmetic satisfaction, surgeon ergonomics, and quality of life** were not performed using validated scoring systems. Similarly, no formal evaluation of the learning curve or ergonomic benefit was undertaken. These outcomes should be assessed in future comparative studies.

Finally, while the concealed suprapubic incision offers an aesthetic advantage, cosmetic outcomes remain subjective and may vary according to individual patient expectations. The principal objective of any modification to laparoscopic cholecystectomy should remain the **safe achievement of the Critical View of Safety** and prevention of bile duct injury rather than cosmetic enhancement alone.[7,8,17]

Overall, SCET should be regarded as a technically feasible modification of conventional laparoscopic cholecystectomy that warrants further validation before broader clinical adoption.

5. Conclusion

The **Sequential Camera Exchange Technique (SCET)** represents a practical modification of three-port laparoscopic cholecystectomy that combines a concealed suprapubic working port with a standardized camera exchange workflow using conventional laparoscopic equipment. In the present case, the technique was completed successfully without additional port placement or conversion while maintaining the principles of the **Critical View of Safety**, achieving satisfactory operative outcomes, early postoperative recovery, and an excellent cosmetic result.[7,8,17]

Rather than introducing new instrumentation or fundamentally altering established operative principles, SCET preserves familiar laparoscopic ergonomics while optimizing visualization during different stages of the procedure through sequential camera repositioning. This standardized workflow may facilitate reproducibility and serve as a practical transition toward reduced-port laparoscopic surgery.

Although the present report demonstrates the **technical feasibility** of this approach, conclusions regarding its superiority over conventional laparoscopic techniques cannot be drawn from a single illustrative case. Larger prospective comparative studies are required to evaluate operative efficiency, learning curve, postoperative pain, cosmetic satisfaction, ergonomics, cost-effectiveness, and long-term safety before widespread clinical adoption can be recommended.

The proposed technique expands the spectrum of reduced-port laparoscopic cholecystectomy and offers a reproducible alternative for surgeons seeking improved cosmetic outcomes **without compromising the fundamental principles of safe biliary surgery**.

Learning Points

- **The Sequential Camera Exchange Technique (SCET)** provides a standardized and reproducible workflow for modified three-port laparoscopic cholecystectomy using only conventional laparoscopic instruments.
- **Alternating the laparoscope between the umbilical and concealed suprapubic ports** preserves ergonomic triangulation, optimizes visualization during different operative stages, and facilitates safe clip application without additional trocars.
- **Strict adherence to the Critical View of Safety remains essential**, irrespective of port configuration or camera position, and should never be compromised in pursuit of reduced-port surgery.[7,8,17]
- **A concealed 10-mm suprapubic port** permits specimen retrieval without creating an additional visible upper abdominal scar, potentially improving cosmetic outcomes while maintaining established laparoscopic principles.
- **The present report demonstrates the technical feasibility of SCET**, but larger prospective comparative studies are required to determine its impact on operative efficiency, postoperative pain, cosmetic satisfaction, surgeon ergonomics, learning curve, and long-term safety.

Key Clinical Message

Sequential Camera Exchange Technique (SCET) enables modified three-port laparoscopic cholecystectomy to be performed safely with conventional instruments while preserving the Critical View of Safety and providing concealed suprapubic specimen retrieval through a standardized, reproducible operative workflow.

Declarations

Ethics Approval and Consent to Participate

This manuscript describes a single patient undergoing an established surgical procedure with a standardized operative workflow. Institutional Ethics Committee approval was not required for publication of this technical report in accordance with institutional policy. The procedure was performed following the ethical principles outlined in the **Declaration of Helsinki (2013 revision)** and accepted standards of good clinical practice.

Written informed consent was obtained from the patient for participation in the study and for the anonymous use of clinical information for academic and scientific purposes.

Consent for Publication

Written informed consent was obtained from the patient for publication of this manuscript, including anonymized clinical information and intraoperative, postoperative, radiological, and pathological images. Every effort has been made to protect the patient's identity, and no identifying information has been disclosed.

Availability of Data and Materials
All relevant clinical data supporting the findings of this report are included within the manuscript. Additional anonymized data may be made available by the corresponding author upon reasonable academic request, subject to institutional policies and patient confidentiality.

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Conflict of Interest
The authors declare **no competing interests** related to this work.

Author Contributions (CRediT Taxonomy)

Prof. Dr. Sanjay Kala
- Conceptualization
- Surgical supervision
- Operative planning
- Critical revision of the manuscript
- Final approval of the manuscript

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- Literature review
- Manuscript editing
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All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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Guarantor
Dr. Shashank Khandelwal accepts full responsibility for the integrity of the work as a whole, from inception to publication, and serves as the guarantor of this manuscript.

Registration of Research Studies
Not applicable. This manuscript describes a **technical report with a single case illustration** and therefore does not require registration as a clinical trial.

Patient Confidentiality Statement
All patient identifiers have been removed from the manuscript and accompanying images. The report has been prepared in accordance with accepted ethical standards to ensure complete confidentiality and privacy.

Reporting Guideline
This manuscript has been prepared in accordance with the **SCARE 2023 (Surgical CAse REport) Guidelines**, with additional emphasis on the detailed description of the operative workflow and technical aspects of the procedure.

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Conflict of Interest
The authors declare that they have no competing interests.

Ethical Approval
Ethical approval was waived as this manuscript describes a single patient undergoing a standard surgical procedure with a novel port configuration. Written informed consent for publication of clinical details and images was obtained from the patient.

Patient Consent
Written informed consent was obtained from the patient for publication of this case report, including clinical details and accompanying images. All efforts have been made to maintain patient confidentiality.

Data Availability Statement
The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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