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Original Article

Efficacy of Ultrasound Guided Bilateral Subcostal Tap Block and Ultrasound Guided Celiac Plexus Block Using a Novel Supra Celiac Approach for Anaesthesia during Open Palliative Feeding Jejunostomy- A feasibility Study

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ABSTRACT

Background: General or Regional anaesthesia are the most common anaesthetic techniques practiced for open palliative feeding jejunostomy (PFJ) for advanced esophageal cancer. However, it is not devoid of technique specific complications accounting to perioperative morbidity and mortality. In this study, a combination of ultrasound guided bilateral Subcostal Transverse abdominis plane (SC TAP) block and a novel supraceliac approach to ultrasound guided Celiac Plexus (CP) block was evaluated for its safety and efficacy in providing surgical anaesthesia for open PFJ.
Methods: This prospective feasibility study was conducted in 15 patients scheduled for open PFJ. We performed bilateral ultrasound guided SC TAP block and ultrasound guided CP block using a novel supraceliac approach to attain surgical anaesthesia for open PFJ. The variables such as percentage of patients requiring intraoperative and postoperative rescue analgesics and pain scores, block success rate, block performance time, duration of postoperative analgesia and side effects were recorded.
Results: Percentage of patients who required rescue analgesics in the intraoperative period and postoperative period were 6.6% and 20% respectively, with a block success rate of 100%. Intraoperative pain scores measured by verbal rating scale was 1 in all the patients except one patient who had a score of 2. Median postoperative pain scores measured by visual analog scale were 0 for first 12 postoperative hours. The side effects were minimal and manageable.
Conclusion: The combination of bilateral ultrasound guided SC TAP block and the novel ultrasound guided supraceliac approach to CP block was a feasible, efficacious, and safe technique to provide surgical anaesthesia for open PFJ in patients with advanced esophageal malignancy.

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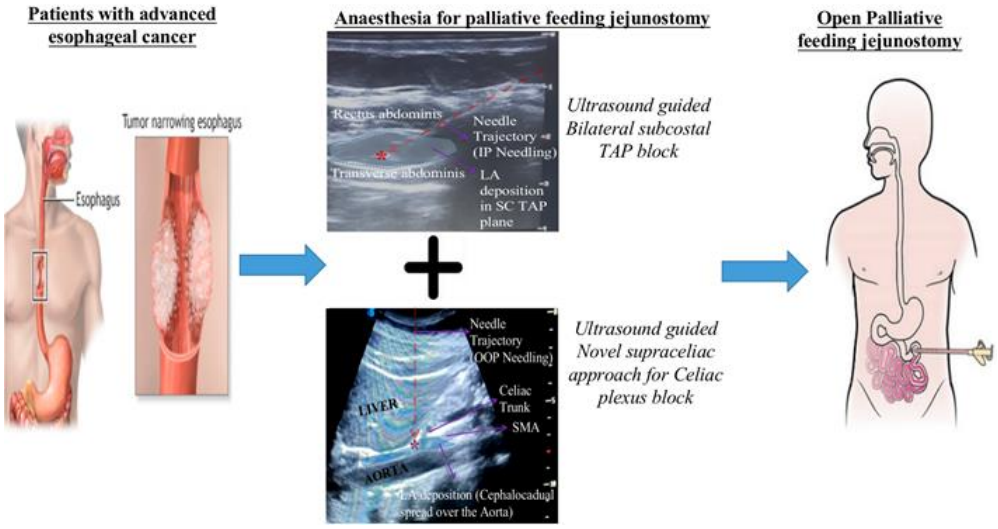
GRAPHICAL ABSTRACT



Introduction

Esophageal cancer is the 9th most common cause of cancer and the 6th most leading cause of cancer related deaths worldwide as described by current literature [1].

Most often, the diagnosis is made in the advanced stages of malignancy with multiple metastasis and obstruction of the digestive tract in which radio-chemotherapy followed by palliative feeding jejunostomy for nutrition is the only available option to improve their quality of life [2-4].

Anaesthesia for such palliative feeding procedures in this particular group of patients is always challenging for anaesthesia care providers. General anaesthesia (GA) and regional anaesthesia (RA) which includes Spinal anaesthesia (SA) or Epidural anaesthesia (EA) is widely being practiced across the world for palliative feeding jejunostomy but it is not devoid of complications in terms of perioperative morbidity or mortality depending on the anaesthetic technique used [5, 6].

Ultrasound guided Transverse Abdominis Plane (TAP) block using Subcostal (SC) approach is widely used to provide postoperative analgesia following open upper abdominal surgeries involving T 6 to T 10 dermatomes [7].

Celiac plexus (CP) is the largest autonomic plexus situated in the retroperitoneum, at the roots of Celiac Trunk (CeT) and Superior Mesenteric Artery (SMA) and innervates most of the abdominal viscera and the bowel loops from stomach to the proximal transverse colon, and thus CP blocks or neurolysis is used to treat chronic pain originating from these structures [8, 9].

There is limited evidence for usage of these two blocks in combination to attain surgical anaesthesia during open palliative feeding jejunostomy [10].

Although SC TAP block can be performed easily by novice anaesthesiologists, the existing approaches of ultrasound guided CP block has a steep learning curve [11, 12].

Hence, we proposed a novel supraceliac approach for ultrasound guided CP block in combination with Ultrasound guided SC TAP block for anaesthesia during open palliative feeding jejunostomy. The aim of this feasibility study was to evaluate the efficacy and safety of combination of Ultrasound guided Bilateral SC TAP block and a Novel Supraceliac approach for Ultrasound guided CP block for surgical anaesthesia in patients with advanced esophageal cancer undergoing palliative feeding jejunostomy. The primary outcome of the study was to evaluate the percentage of patients requiring intra-operative rescue analgesics.

The secondary outcomes of the study were to assess the block success rate, to assess the number of doses of intraoperative rescue fentanyl, block performance time, block failure rate, duration of postoperative analgesia, postoperative pain scores by visual analog scale, total number of rescue tramadol in 24 hours, intraoperative and postoperative hemodynamics (heart rate, mean blood pressure, SpO_2), satisfaction scores of block performer, patient, and surgeon, and also incidence of side effects such as significant hypotension, vascular puncture, bowel injury, hematoma, diarrhea, local anaesthetic systemic toxicity, and paraperesis/paraplegia.

Materials and Methods

This prospective feasibility study was conducted in a Saveetha medical college and hospital in Chennai, Tamilnadu, India from January 2022 to December 2022.

This study was conducted in agreement with the principles of declaration of Helsinki. After obtaining informed and written consent for anaesthesia and participation in the study without revealing patient identity, 15 patients belonging to American society of Anaesthesiologists (ASA) III with advanced esophageal carcinoma were recruited for this study using continuous sampling technique.

The study was approved by the Institutional Review Board. Adult patients were at the age range of 18 to 70, belonging to either sex suffering from inoperable advanced stage of esophageal cancer in chemotherapy or radiotherapy belonging to ASA III scheduled for open palliative feeding jejunostomy during the study period in the same institute, were included for the study.

Patients who refused to participate, patients with injection site infection, patients allergic to local anaesthetic medications, patients in intraabdominal sepsis, patients with intraabdominal metastasis, severe coagulopathies, uncontrolled glycemic control, uncontrolled blood pressure control, severe dehydration, patients with gaseous bowel distension, patients with anatomical variations of celiac trunk, descending abdominal aorta and metastatic mass around the celiac plexus, preservation of retroperitoneal fat in pre/para aortic location, presence of any other associated pathology such as ascites and aortic aneurysm identified during preoperative screening ultrasound and Computer tomography (CT), patients with psychiatric illness, and patients with mini mental state examination score of less than 24, decompensated cardiac, liver, and renal disease were excluded from the study.

All the patients who were enrolled for the study were kept nil per oral for 8 hours from the previous day night. Their bowels were prepared with enema on the previous night and they were connected to intravenous fluids of ringer lactate at the rate of 2 ml per kilogram through a peripheral 20 Gauge intravenous cannula to avoid pre-operative dehydration. They were pre-medicated with intravenous Injection Pantoprazole 40 mg and Injection Metoclopromide 10 mg the night before and on the morning of surgery.

On the day of surgery, upon arrival to the operating room, patients were kept in supine position on the operating table and ASA standard monitors (noninvasive blood pressure, electrocardiogram, and pulse-oximetry) were connected and baseline vitals were recorded. Preoperative scout scan was done over the abdomen to rule out anomalous abdominal Aorta/CeT, gaseous distension of the abdomen and direct invasion of the CP by any tumor or metastasis.

An 18 Gauge intravenous cannula was established in the non-dominant upper limb and the patients were pre-loaded with 10 ml/kg of Ringer lactate solution. The patients were given pre-procedural sedation with intravenous Injection Midazolam 0.5mg and Injection Fentanyl 20 microgram to maintain a Ramsey Sedation Scale of 2 and all patients were administered 4 liters of oxygen through Hudson's mask.

Initially bilateral SC TAP block were performed as described by Soliz *et al.* [7].

The patients were kept in supine position and the anterior abdominal wall were painted with antiseptic solution and draped aseptically. The

High frequency linear probe (6 to 13 Mhz) with musculoskeletal preset from an GE logic E series GE, USA Inc. Ultrasound system was used to scan the anterior abdomen. After sterile draping of the ultrasound probe, the probe was placed obliquely just below the SC margin close to the midline to identify the rectus abdominis muscle on one side. Then, the probe was moved obliquely and laterally to identify the transverse abdominis muscle just beneath the lateral border of rectus abdominis muscle, as shown in Figure 1A. The interfascial plane between the rectus abdominis and transverse abdominis muscle was identified. After local infiltration of the skin puncture site, A 23 Gauge 10 cm long quincke needle was used an In-Plane (IP) needling from medial to lateral direction to park the needle in this interfascial plane. Initial 2 to 3 ml of saline was deposited to open up the plane, and then 15 ml of 0.375 % Ropivacaine with dexa 4 mg was deposited in intermittent 3 ml aliquots after careful negative aspiration of blood to avoid intravascular injection. The expansion of the intermuscular plane by the injectate was ensured during the injection as shown in Figure 1B. The same procedure was repeated on the other side as well. After ensuring the block success by assessing with cold swab testing from T6 to T10 dermatome on either side of the abdomen, the CP block was performed.

Our novel technique of ultrasound guided CP block was performed as described below. Low frequency curvilinear probe (2 to 6 MHz) with abdomen preset from an GE logic E series GE, USA Inc. Ultrasound system was used for the block. After sterile draping of the probe, the probe was kept in the epigastric region in longitudinal orientation in the midline just below the xiphi sternum to identify the anterior abdomen wall and underlying Liver and descending abdominal Aorta arising from the diaphragmatic orifice along with its ventral branches (CeT and SMA) and vertebral bodies, as depicted *in* Figure 2A. The aorta and CeT was confirmed by the thickened walls, pulsating nature and double confirmed with color Doppler, as indicated in Figure 2B. A 10 centimeter long 23 G quincke needle was introduced by Out-of-Plane (OOP) needling through the liver in order to reach the target region between the Abdominal Aorta and base of the origin of the CeT underneath the liver bed, as shown in Figure 2C. Initial give way of needle was felt when the needle crossed the anterior capsule of the liver, and then the needle was carefully inserted slowly feeling the gritty sensation of the liver and after further needle insertion, a second give way was felt when the needle crossed the posterior liver capsule. For doubt on the needle tip identification, 2 to 3 ml of normal saline was injected to confirm the needle tip. The needle tip was parked in front of the aorta just cephalad to the base of origin of CeT and 3 to 5 ml of normal saline was injected to identify the correct region of deposition of injectate. After confirming the spread of the injectate in the target region, injection of 1% Lignocaine with adrenaline of 10 ml was deposited in intermittent 2 ml aliquots after careful negative aspiration of blood to avoid intravascular injection. The spread of the injectate occurred in a cephalo-caudal direction along the long axis of the descending aorta, as illustrated in Figure 2C.

During the injection, the operating table was put to 20 degrees of reverse trendlenburg position for a transient period to ensure the gravity dependent caudal spread of the injectate to bathe all the ganglia of the CP around the CeT and SMA. The probe was placed in the transverse orientation at the level of CeT and local anaesthetic spread within the CP was visualized. After 15 minutes observation for the hemodynamics, the patient was handed over to the surgeon. All the surgeries were performed by a single well experienced surgeon with a midline incision between T7 to T9 dermatome of not more than 5 cm of length of incision. All the photographs were taken by one of the contributing authors (V.S.G. Yachendra).

To facilitate double blinding, all the blocks were performed by a single anaesthesiologist with 5 years of experience with ultrasound guided regional blocks who did not take part in the study after the block. The outcomes in the intra-operative and postoperative period were assessed by a different anaesthesiologist who did not witness and did not know about the block done by the first anaesthesiologist.

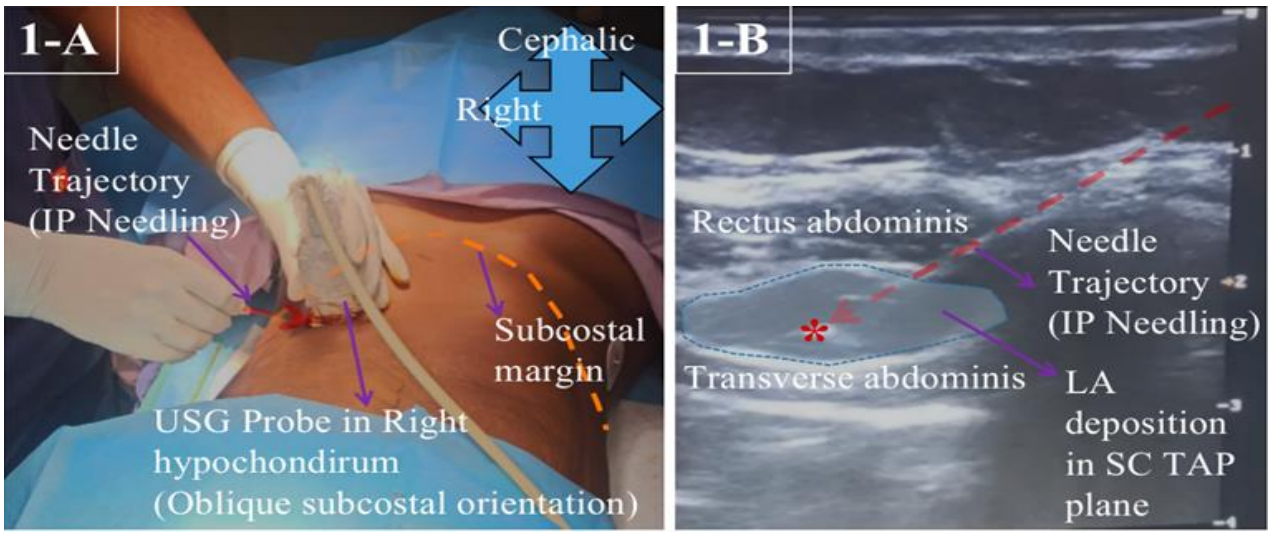


Figure 1: (A) Ultrasound Probe position and In-Plane (IP) needle orientation for Subcostal TAP (SC TAP) block and (B) Ultrasound image showing the target location (*****) and Local anaesthetic (LA) deposit in SC TAP plane with block needle trajectory. **Photo Courtesy**: V.S.G. Yachendra (Contributing author).

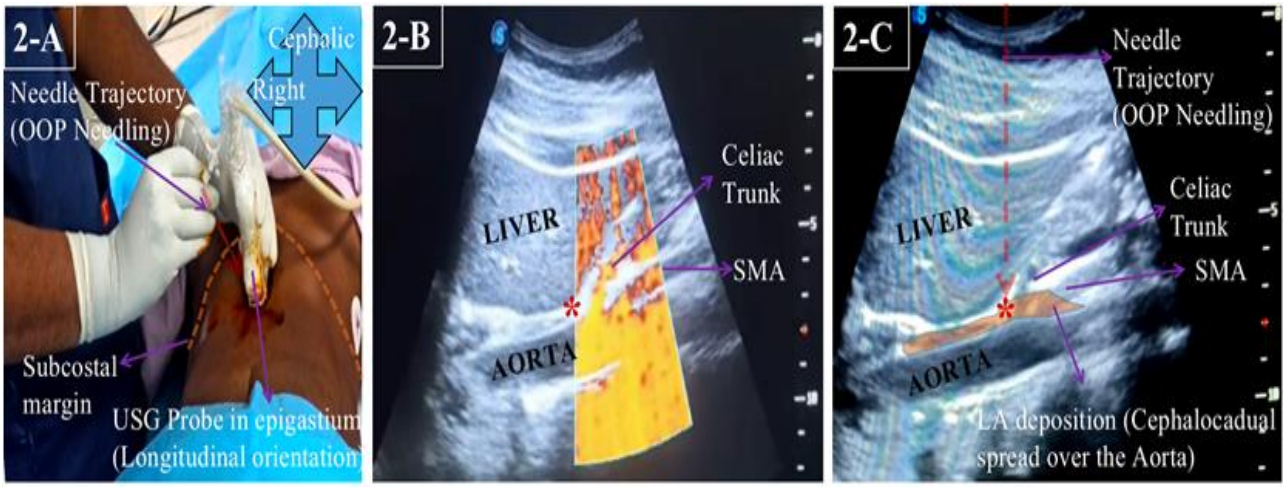


Figure 2: (A) Ultrasound probe position for Novel Supraceliac approach for celiac plexus block with Out-of-plane (OOP) needling orientation, (B) Ultrasound image in Doppler mode to confirm the Aorta, Celiac trunk, Superior mesentric artery (SMA) and the Target location(*), and (C) Ultrasound image in B mode showing the Target location, the block needle trajectory and the Local anaesthetic (LA) deposit including cephalocadual spread of LA over the Aorta bathing the Celiac plexus in the vicinity of the Celiac trunk and SMA. **Photo Courtesy**: V.S.G. Yachendra (Contributing author).

The intraoperative pain score of the patients were assessed by a 4 point verbal rating scale (VRS) if the patients complained pain. The 4-point verbal rating scale was as follows; (i) no pain ("It does not hurt at all"), (ii) mild pain ("The pain is tolerable"), (iii) moderate pain ("It hurts a lot"), and (iv) severe pain ("It hurts to die"). Patients were asked to choose the most appropriate word that describes their current pain.

We defined "Block success rate" as the verbal rating scale less than 2 during the surgery with or without requirement of one rescue dose of 0.5 microgram per kg of fenatnyl. The surgical step which generated pain was noted to differentiate between somatic pain and visceral pain.

If further fentanyl or any other anaesthetic agent was required, the block was considered as "failed block", and then the patient was excluded from the study and general anaesthesia was administered. This decision was taken according to the discretion of the attending anaesthesiologist. Hemodynamics such as MAP, HR, and SpO_2 were recorded from baseline,

during the blocks and thereafter every 15 minutes till 90 minutes during the intraoperative period.

The same hemodynamic parameters were measured in the post anaesthesia care unit (PACU) also from on arrival of PACU, 2 hours, 4 hours, 8 hours, 12 hours, and 24 hours. Hypotension was defined as fall in MAP below 20 % of baseline and the same was treated with fluid boluses and ephedrine 6 mg. Bradycardia was defined as heart rate less than 45 beats per minute and treated with atropine 0.6 mg if encountered.

Postoperative pain was assessed by Visual Analog Scale (VAS) and measured from on arrival to PACU and thereafter 2 hours, 4 hours, 6 hours, 8 hours, 12 hours, 18 hours, and 24 hours. 10 point VAS pain score was explained to all patients (VAS 0 - no pain and VAS 10- the worst possible pain). Injection Tramadol 2 mg per kg along with Injection Ondonsetron 4 mg was administered as rescue analgesic when postoperative VAS score was more than 3 and the same dose was repeated whenever the VAS increased more than 3 in the 24 hour postoperative period.

Duration of postoperative analgesia was also noted and was defined as the time since the patients were admitted to PACU to time VAS became more than 3 in the postoperative period.

At the end of 24 hours, satisfaction scores of the Block Performer, patient, and the surgeon were assessed by means of four point Likert scale (1- Very Dissatisfied, 2 - Somewhat Dissatisfied, 3- Somewhat Satisfied, and 4 - Very satisfied). Incidence of Side effects such as hypotension, vascular puncture, bowel injury, hematoma, diarrhea, local anaesthetic systemic toxicity and paraperesis or paraplegia was also noted if present.

Statistical analysis

Sample size of 15 people was selected as per convenience and availability of patients since this is a feasibility pilot study. All the data were recorded in Microsoft Office Excel 2019. Statistical analysis was carried out using Statistical Package for the Social Sciences (SPSS) version 19.0 (Armonk, NY: IBM corp) software. Descriptive analyses were reported as mean and standard deviation of continuous variables. Qualitative data were reported as percentages and Median with range.

Results and Discussion

15 patients were recruited and analyzed in this feasibility study with no drop outs during the analysis. The demographic parameters of the patients along with the Duration of Surgery and Block performance time are described in Table 1.

All the patients belonged to ASA grades III and X of them had comorbidities. Patients with systemic hypertension were 5/15 (33.3%), patients with diabetes mellitus were 3/15 (20%), and patients with combination of both systemic hypertension and diabetes were 2/15 (13.3%).

Table 1: Demographic parameters, Block performance time, and Duration of surgery

Patient Characteristics (n = 15)	Mean and Standard Deviation	Range
Age (years)	61.7 ± 6.8	54 to 72
Sex in numbers (percentage)	M: F = 9/15: 6/15 (60% / 40%)	
Height (centimeters)	161 ± 6.1	151 to 172
Weight (kilograms)	54.4 ± 5.8	48 to 66
BMI (kg/square meter)	20.9 ± 1.3	18 to 23.7
A - Block performance time for Bilateral Subcostal TAP block (minutes)	8.7 ± 1.1	6 to 10
B - Block performance time for Novel Supraceliac approach Celiac plexus block (minutes)	8.8 ± 1.2	6 to 10
Total Block performance time (A + B) (minutes)	17.5 ± 1.4	15 to 20
Duration of Surgery	60.6 ± 10.6	45 to 80

All 15 patients were given blocks as described before. The expected sensory level of T6 to T10 dermatomes as examined by cold swab were obtained on both sides in all patients after Bilateral subcostal TAP block.

The percentage of patients who required rescue analgesics (Fentanyl) in the intraoperative period was 6.6% (1/15). The same patient complained pain of VRS of 2 (Mild tolerable pain) upon manipulation of Rectus abdominis muscle during the surgery. He was given one rescue dose of Fentanyl upon which the pain subsided to VRS of 1 (no pain) and the surgery was performed uneventfully. The Block success rate was 100 % (15/15) with no incidence of failed blocks and conversion of general anaesthesia.

The percentage of patients who developed pain of VAS more than 3 in the postoperative period in PACU during 24 hour postoperative observation were observed to be 20% (3/15).

All three patients who developed pain in postoperative period experienced pain after 16 hours upon admission to PACU. All three of them were alleviated of pain with one dose of rescue Tramadol in the postoperative period and did not require any further doses rescue analgesics in the 24 hour postoperative period.

The Mean Duration of postoperative analgesia in all 15 patients was 23.2 ± 3.2 hour. The postoperative pain scores are described in Table 2.

The Hemodynamic parameters such as HR, MAP, and SpO_2 across the intraoperative and postoperative period are presented in Table 3.

Table 2: Postoperative VAS pain score expressed as median and range

Time points in the Postoperative period	Postoperative Visual analog scale (VAS) Pain score	
	Median	Range
On arrival to PACU	0	0 - 0
The 2nd hour	0	0 - 0
The 4th hour	0	0 - 0
The 6th hour	0	0 - 0
The 8th hour	0	0 - 0
The 12th hour	0	0 - 2
The 18th hour	1	0 - 5
The 24th hour	2	1 - 3

Table 3: Hemodynamic parameters during Intraoperative and Postoperative period (**CPB*:** Celiac plexus block and **PACU****: Post Anaesthesia Care Unit) expressed in mean and standard deviation

Time points in Intraoperative and Postopertaive period	Heart rate (beats per minute)	Mean arterial pressure (mm Hg)	Saturations SpO_2 (%)
Preoperative Baseline	85.1 ± 11.5	80.2 ± 10.3	97.8 ± 0.9
During CPB* block	91.4 ± 10.3	82.8 ± 11.8	99.2 ± 0.5
The 15th minute	83.3 ± 11.1	72.8 ± 10.3	99.3 ± 0.6
The 30th minute	78.5 ± 9.3	75 ± 11.4	99.2 ± 0.6
The 45th minute	73.8 ± 6.3	75.2 ± 11.2	99.2 ± 0.5
The 60th minute	72.5 ± 6.2	76.8 ± 12.1	99.2 ± 0.5
The 75th minute	72.2 ± 6	75.7 ± 10.8	99.2 ± 0.6
The 90th minute	71.2 ± 6.1	76.6 ± 12.1	99.2 ± 0.5
On arrival to PACU**	73.8 ± 6.6	78.1 ± 11.2	98.3 ± 0.7
The 2nd postoperative hour	71.8 ± 5.2	77.4 ± 10.8	97.8 ± 0.9
The 4th postoperative hour	71.3 ± 5.9	77.2 ± 10.3	97.9 ± 0.7
The 8th postoperative hour	71.2 ± 6.8	77.6 ± 11.7	97.6 ± 0.9
The 12th postoperative hour	72.9 ± 5.9	78.1 ± 12.5	97 ± 0.9
The 24th postoperative hour	80.9 ± 7.6	82.5 ± 9.8	98.1 ± 0.9

Table 4: Four point Likert scale for satisfaction scores of patient, Block performer, and the surgeon expressed in percentages

Four point Likert scale	Patient's Satisfaction score	Block Performer's Satisfaction score	Surgeon's Satisfaction score
Very Dissatisfied (%)	0	0	0
Somewhat Dissatisfied (%)	0	0	0
Somewhat Satisfied (%)	20	6.6	6.6
Very Satisfied (%)	80	93.3	93.3

All 15 patients developed hypotension within 15 to 30 minutes of celiac plexus block, but only 4 out of 15 patients (26.6%) developed significant hypotension that were managed accordingly. None of the patients were observed to have bradycardia and desaturations.

The incidence of side effects such as significant hypotension and diarrhoea were 26.6% (4/15) and 13.3% (2/15), respectively. The hypotension was managed with one dose of intravenous Ephedrine 6mg and 250 ml of intravenous fluid boluses.

The transient diarrhoea (two episodes for both the patients), which occurred in the postoperative period, was self-limiting and did not occur thereafter. Side effects such as vascular puncture, bowel injury, hematoma, local anaesthetic systemic toxicity, and paraperesis/paraplegia were not observed.

The satisfaction scores of Patient, Block performer and surgeon are expressed by means four point Likert scale as in Table 4.

Anaesthesia for feeding jejunostomy is always challenging because each patient presents with varying degree of malnourishment, geriatric profile and frailty along with comorbidities [13].

It is commonly performed under GA or central neuraxial blocks such as SA or EA. Both of these techniques have an inherent disadvantages of unstable hemodynamics apart from technique specific adverse effects [5, 6]. This group of patients seldom tolerates such hemodynamic fluctuations perioperatively. Hence, there is always a need for a more reliable, efficacious, and hemodynamically stable anaesthetic technique which can be easily performed by novice with minimal equipment. The anterior abdominal wall from skin to the parietal peritoneum is innervated by the T6 to T 12 spinal nerves [14]. The autonomic supply of upper abominal viscera and the bowels including the visceral peritoneum is provided by the CP [15]. Both lower thoracic spinal nerves and celiac plexus carries nociceptive somatic and visceral afferent inputs of the corresponding areas which these innervates [16].

Feeding jejunostomy involves mini laparotomy through a midline incision between T7 to T9 dermatomes in the anterior abdominal wall followed by enterotomy and fixation of a feeding tube inside the jejunal loop [17]. Hence, we have used SC TAP block to block the T6 to T10 spinal nerves to facilitate anterior abdominal wall manipulation and CP block to facilitate bowel handling during feeding jejunostomy.

Subcostal TAP block is most commonly used technique to provide postoperative analgesia for upper abdominal surgeries [7].

CP block or neurolysis is most commonly used for alleviating malignant pain arising from the upper abdominal viscera [8, 9].

However, we have used both of these techniques to attain surgical anaesthesia for feeding jejunostomy in our study. Unlike SC TAP block, CP block with (without) guidance, is always challenging among clinicians.

There are many described approaches of CP blocks such as anterior and posterior approaches using Landmark guidance, Fluoroscope guidance, CT guidance, Magnetic Resonance imaging (MRI) guidance, percutaneous ultrasound guidance, and recently endoscopic ultrasound guidance [9,15,18].

In the percutanous anterior ultrasound guided approach, there are only two described techniques in literature. The first approach as described by Damija *et al.* [11], a curvilinear probe is placed in the transverse orientation just below the xiphisternum in the epigastrium to identify the descending abdominal aorta and

bifurcation of the CeT into hepatic artery and splenic artery (Seagull sign). A paraaortic fat plane is visualized on either side of the celiac trunk and needle entered through transhepatic or transgastric technique to reach this fat plane using in-plane needling. 30 ml of diluted local anaesthetic with or without neurolytic is deposited in this fatty plane.

Drug gets distributed into the fatty plane bathing the CP. The second approach as described by Chansoria *et al.* [12], the curvilinear probe was kept in the longitudinal orientation, just below the xiphisternum in the midline, to identify the descending abdominal aorta and its branches such as CeT and SMA. The needling was done in caudocephalic direction, using in-plane needling to reach the needle tip between the CeT and SMA which forms the "Trident sign" along with the block needle. 10 ml of diluted local anaesthetic was deposited with careful negative aspiration to blood. The drug spread was ensured around the CeT, SMA, and aorta.

The First approach using the "seagull sign" has a major disadvantage of intrapancreatic needle placement since the pancreatic tissue camouflages with the para aortic fat pad in ultrasound and can induce acute pancreatitis. The second approach using "Trident sign" has a major disadvantage of inadvertant intravascular drug deposition and local anaesthetic systemic toxicity in the view of close proximity between CeT and SMA. Both have the inherent disadvantage of getting the needle in an in-plane manner which is extremely difficult for novice and even with experienced anesthesiologist. Hence, we have proposed a novel approach of ultrasound guided CP block to overcome the above mentioned hurdles.

The Advantages of this novel supraceliac approach of ultrasound guided CP block used in our study in comparison with other described techniques are as follows: Firstly, we feel that the learning curve to target acquisition using this novel technique is short, even for novice anaesthesiologist since scanning and identification of midline structures like liver, descending aorta and CeT can be easily visualized without much difficulty. Second, we recommend median longitudinal position of the ultrasound probe for scanning for this novel approach to CP block since most of these patients have a very narrow SC angles and hence it will be difficult to position the probe in horizontal position to obtain the "segull sign".

Third, we recommend OOP needling for this block since IP needling will require more needle length to reach the same target and there may be increased chance of accidental intravascular puncture of CeT and SMA during in plane needling as in the approach with "trident sign".

Fourth, the needling track is devoid of major blood vessels and through the left lobe of the liver and its capsular covering which gives a gritty feel and "give a way" feel, respectively, while needle tip advancement, so it gives a control and prevents overshooting of needle into the other undesirable structures and directs to target location.

Fifth, the spread of the injectate occurs with the long axis of the aorta caudally bathing all the ganglia of the CP around the CeT and SMA due to the gravity and transient reverse trendlenburg position during the block.

Finally, this novel approach to CP block does not require high quality premium ultrasound systems for scanning; it can be easily performed with all commonly available ultrasound systems in operating rooms.

The percentage of patients who required intraoperative rescue fentanyl was 6.6% (1/15) in our study. Elsabenny *et al.* [5] compared the efficacy of continuous Thoracic segmental EA and GA for Feeding jejunostomy and found that intraoperative rescue fentanyl was required in 4.8% (1/21) and 59% (13/22), respectively. Srikanth *et al.* [10] performed ultrasound guided bilateral TAP block and CP block in a respiratory cripple posted for feeding jejunostomy and performed the case with 25 micrograms of fentanyl for intraoperative sedation.

Bharathi *et al.* [19] facilitated anaesthesia for feeding jejunostomy with bilateral SC TAP block and dexmeditomedine sedation without any opioids. Bhatia *et al.* [20] performed ultrasound guided bilateral TAP block for 8 patients scheduled for open epigastric hernia repair and required rescue fentanyl of 25 micrograms twice for two patients.

All these studies show that it is imperative to address both somatic pain and visceral pain by peripheral nerve blocks and sympathetic blocks for intraabdominal procedures of bowel loops. If either this block fails, opioids supplementation or change of anaesthetic care plan to GA may be warranted. Block success rate in our study was 100% and this result was comparable with Bhatia *et al.* [20] and Elsabenny *et al.* [5].

The percentage of patients who required postoperative rescue Tramadol was 20% (3/15) in our study and all the pain subsided with one dose of Tramadol 100 mg. Elsabenny *et al.* [5] reported a postoperative rescue morphine requirement of 4.8% (1/21) and 100% (22/22) with continuous segmental thoracic EA and GA, respectively. Bhatia *et al.* [20] reported that 25% (2/8) of patients required two doses of paracetamol in the postoperative period and rest of the patients were pain free in the postoperative period. Kadam *et al.* [21] performed USG guided continuous TAP block with catheter and administration of CP block by surgeon in two patients who underwent open gastric bypass and whipple's procedure with general anaesthesia at the end of the surgery before abdominal closure. They reported that both the patients required postoperative fentanyl as rescue analgesic. Mean duration of postoperative analgesia was 23.2 ± 3.2 hour in our study. Median duration of postoperative analgesia was 24 hours with range of 6 to 24 hours as reported by Bhatia *et al.* in their study. Kadam *et al.* [21] reported duration of 8 to 12 hours of pain free period for their patients in the postoperative period.

Hemodynamic profile observed in our study was comparable with that of Elsabenny *et al.* [5]. In our study, only 26.6% (4/15) patients had significant hypotension (<20% drop in MAP) following CP block and others had hypotension but was not significant.

Chansoria *et al.* [12] reported that 33.25% (10/31) of their patients had hypotension and Elsabenny *et al.* [5] reported 23.8% (5/21) and 14.2 % (3/22) with continuous segmental thoracic EA and GA, respectively.

In our study, 13.3% (2/15) had self-limiting diarrhea in the postoperative period. Chansoria *et al.* [12] reported 64.5% (20/31) of increased defecation. Patient satisfaction scores and surgeon satisfaction score of our study were comparable with Elsabenny *et al.* [5] and Bhatia *et al.* [20], respectively.

The major limitation of the study was that it is a feasibility study with limited study population. Hence, many more randomized controlled trials with more sample size should be conducted using the same technique in comparison with other regional and general anaesthesia to further validate this study.

Second, we did not document the onset of anaesthesia because there are two blocks involved (somatic block and sympathetic block) and it is difficult to decipher the onset of CP block since the stimulus for the visceral pain is the surgical manipulation of the bowel, and thus it is difficult to report the onset of surgical anesthesia.

Conclusion

The combination of bilateral ultrasound guided SC TAP block and the novel ultrasound guided supraceliac approach to CP block was a feasible, efficacious, and safe technique to provide surgical anaesthesia for feeding jejunostomy in patients with advanced esophageal malignancy in terms of higher block success rate, lesser intraoperative and postoperative pain score and lesser opioid consumption with minimal complications and better patient satisfaction scores. This anaesthesia technique can be considered as a safe alternative to other techniques of anaesthesia in this group of patients for open feeding jejunostomy.

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Authors' Contributions

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