

## Caudal Anaesthesia in Ambulatory Colonoscopy: Lidocaine Only vs. Lidocaine/fentanyl Combination

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### Abstract

**Background:** This study aimed to compare the analgesic effects of caudal anaesthesia in patients undergoing ambulatory colonoscopy using lidocaine only or lidocaine/fentanyl combination.

**Methods:** Fifty-one consecutive adult patients scheduled for colonoscopy participated in the study. Participants were randomly allocated into two equal groups (A and B). Caudal anaesthesia was instituted in both groups with 1.5% preservative free lidocaine (19.4 ml); 0.6 ml of normal saline was added in Group A and 30 mcg of fentanyl made to 0.6 ml in Group B. The time of onset and height of caudal block, Numeric Pain Rating Scale (NPRS) score at different stages during colonoscopy were evaluated and compared. The number of patients requiring rescue analgesia (fentanyl/midazolam) were also evaluated and compared.

**Results:** Twenty-six patients in the saline-lidocaine group (A) and twenty-five patients in the fentanyl-lidocaine group (B) completed the study. The mean and standard deviation of the caudal block onset time (minute) in group A was  $11.71 \pm 4.26$  comparable to group B which was  $13.50 \pm 4.85$ ,  $p=0.15$ . The median NPRS while navigating the splenic flexure was 2 in group A and 3 in group B; and while navigating the hepatic flexure it was 5 in group A and 3 in group B. But p values are 0.285 and 0.031 respectively. Rescue analgesia was employed in fewer number of patients in group B (16%) compared to group A (34.6%).

**Conclusion:** Caudal epidural block with lidocaine/fentanyl combination provided superior, safe and satisfactory anaesthesia for ambulatory colonoscopy.

**Keywords:** Ambulatory; Caudal block; Colonoscopy; Sedation

### Introduction

During the process of endoscopic navigation especially along the anorectal canal and sigmoid colon, patient may perceive an unbearable painful discomfort, even with intravenous analgesia and sedation [1]. It is known that the nerve pathway for anal canal sensation is via the inferior haemorrhoidal branches of the pudendal nerve to the sacral nerve roots of S2, S3 and S4. The afferent somatic nerves that expand from L1 to S5 in the sigmoid colon mesentery also transmit nociceptive painful stimuli from the sigmoid colon [2]. Therefore, the somatic afferent innervation along the sigmoid colon where nociceptive stimuli is transmitted, can be blocked centrally using caudal epidural local anaesthetics, with or without adjunct. Caudal epidural block with lidocaine using blind injection technique is routinely employed at our institution for various ambulatory surgical endoscopy including proctological and endo-urological procedures [3-5]. The aim of this study was to evaluate the analgesic effects of caudal anaesthesia in ambulatory colonoscopy using lidocaine only or lidocaine and fentanyl combination.

### Patients and Methods

This was a prospective, double blind, randomized study aimed at determining the efficacy of caudal anaesthesia in ambulatory

colonoscopy: comparing lidocaine or lidocaine and fentanyl combination. Following institutional ethics committee approval and written informed consent, 56 consecutive adult patients, ASA physical status I or II who were accompanied by responsible adults and scheduled for ambulatory colonoscopy, were recruited to participate in the study. Exclusion criteria included patients' age less than 18 or above 80 years, ASA III or IV, uncooperative or refusal to give consent, allergy to the study drugs and previous history of lower abdominal surgery, body mass index (BMI) of  $<18.5$  or  $>35$ , pregnant patients, febrile illness or infection at site of injection. Patients with bleeding disorders, hypovolemia, sacral anomaly/injury or those with pre-existing neurological disease were also excluded from the study.

The pre-anaesthetic assessment of all the participants scheduled for colonoscopy as a day-case procedure was conducted on the day of the procedure to determine their fitness. The purpose of the study was explained to the participants including the use of the pain assessment tool. The patients were randomized prospectively by an independent observer into two equal groups, using simple table of random numbers generated by a computer: Group A (Lidocaine and Saline) and Group B (Lidocaine and Fentanyl). The study drugs were prepared by one of the authors (TAA) for onward delivery to the participating nurses and use during colonoscopy by the principal investigator (OOA). Routine standard check of equipment (anaesthetic machine, airway and resuscitation devices inclusive) was performed and base-line pulse rate, blood pressure, respiratory rate, SpO<sub>2</sub>, and pain score were taken. The

peripheral venous access was secured preferably on the left forearm and all the participants were pre-medicated with intravenous midazolam at 0.025 mg/kg body weight for anxiolysis. On arrival at the endoscopy room, all participants were positioned either in lateral decubitus or prone by the investigator who was blinded to the study drugs for caudal block.

**Caudal anaesthesia technique:** Following aseptic preparation and anaesthesia of the skin over the injection with, 1 milliliter (ml) of 2% lidocaine, caudal block was performed using 19-21G hypodermic needle depending on the patient's physical habitus. The needle was further introduced at an angle 45 degree in relation to the skin between the two cornua and proximal to the vertex of the sacral hiatus until a 'pop' was heard as it penetrated the sacrococcygeal ligaments and entered the sacral canal. The number of attempt (s) taken to achieve a sacral canal needle placement was recorded.

Test-aspiration was done to confirm absence of cerebrospinal fluid (CSF) and blood; and a test dose of 3 ml of 1% lidocaine with epinephrine (1 in 200,000) was administered. Increased heart rate of greater than 10 beat per minute or an increased systolic blood pressure greater than 15 mmHg was considered as a systemic intravascular injection. Single-shot of local anaesthetic consisting of 19.4 ml of 1.5% lidocaine plus 0.6 ml of saline (Group A) or 19.4 ml of 1.5% Lidocaine plus 30 mcg of Fentanyl made to 0.6 ml (Group B) was injected slowly, with repeated test-aspiration per injection in all patients. Subcutaneous or periosteal injection was excluded or confirmed by palpation with the other hand for subcutaneous swelling and presence of pain. At such instances, the needle is withdrawn and re-introduced.

### Outcome measures

The onset time of caudal block was taken as the time from LA injection to the attainment of two or three segmental block.

The duration of sensory block was taken as the time from LA injections to when there were two segment regressions.

The height of block was assessed by an independent observer using sensory level to cold with methylated spirit soaked gauze and pin-prick every 1 minute during the first 10 min and every 2 min over the next 20 min of instituting caudal block with only the highest sensory level recorded.

A modified Bromage Score (1=complete block; unable to move feet or knee, 2=almost complete block; able to move feet only, 3=partial block; just able to move the knee, 4=detectable weakness of hip flexion, 5=no detectable weakness of hip flexion while supine with full flexion of knees) was assessed and recorded every 5 min over 20 min after caudal injection, after colonoscopy and one hour after.

### Pain intensity assessment

Pain intensity using Numerical Pain Rating Scale (NPRS) was assessed at the following stages by the assisting anaesthetist: at the insertion of colonoscope through the anus, splenic flexure and the hepatic flexure. NPRS greater or equal to 4 at insertion of colonoscope was considered as the first end-point of the study and patients who had this score were excluded from the study. The caecal intubation was the time taken from point of insertion of the endoscope to reach the caecum and the procedural duration spans from the point of endoscopic insertion to the point of reaching the terminal ileum. Patients who had NPRS greater or equal to 4 beyond the point of

insertion had rescue dose of intravenous (IV) midazolam dose at 0.025 mg/kg and fentanyl at 0.1 mcg/kg.

**Post-procedural Assessment:** Post-procedural cardiorespiratory monitoring was done in the recovery room by the trained nurses, until patients were clinically fit for discharge. The patient's motor block was considered resolved upon recovery of hip flexion weakness; return of sensation in the perineal area; plantar flexion of the foot and were subsequently ambulated. The patients' recovery profile was evaluated using Post Anaesthetic Discharge Scoring System (PADSS) assessed at 20 min interval after colonoscopy following which a decision for discharge was taken after two-consecutives PADSS of equal or greater than 9. Patient's level of satisfaction was determined immediately after the colonoscopy or via phone call from their homes within 24 h of discharge using a 5-point Likert scale whereby 1=Extremely dissatisfied; 2=dissatisfied; 3=Neutral; 4=Satisfied; 5=Extremely satisfied.

The data obtained were subjected to statistical analysis using Statistical Package for Social Sciences (SPSS) for windows version 22.0, Chicago, USA. Mean values and standard deviations of continuous variables were obtained. Statistical associations were determined using the Chi-square ( $\chi^2$ ) test for categorical variables, p-value of less than 0.05 was considered significant.

## Results

### Demographics and pre-operative data

Fifty-six patients were recruited to participated in this study, however; 5 patients were excluded due to NPRS of greater or equal to 4 at insertion of colonoscope (2 in Group A & 3 in Group B). Data from the 51 patients who completed the study were analysed. Table 1 shows the socio-demographic characteristics of the patients and indications for colonoscopy. The overall first and second attempts at successful caudal needle injection for group A was 61.5% and 80% in group B, despite this difference in percentage there was no statistical significance.

Parameter	Group A (N=26) (%)	Group B (N=25) (%)
<b>Age (years)</b>		
<50	8 (30.8)	14 (56.0)
50-59	4 (15.4)	5 (20.0)
≥60	14 (53.8)	6 (24.0)
<b>Gender</b>		
Male	7 (24)	15 (61.5)
Female	19 (76)	10 (38.5)
<b>Body mass index</b>		
Normal	14 (53.8)	14 (56.0)
Over-weight	12 (46.2)	11 (44.0)
Obese	0 (0.0)	0 (0.0)
<b>Position at Caudal Anaesthesia</b>		
Lateral decubitus	24 (92.3)	22 (88.0)

Prone	2 (7.7)	3 (12.0)
<b>Successful needle placement</b>		
First Attempt	14 (53.8)	8 (32.0)
Second Attempt	2 (7.7)	12 (48.0)
Other	10 (38.5)	5 (20.0)
<b>Indication for colonoscopy</b>		
Surveillance Colonoscopy		
Rectal bleeding	14 (53.8)	12 (48.0)
Abdominal pain	6 (23.1)	9 (36.0)
Abnormal bowel habit	11 (42.3)	16 (64.0)
<b>Interventional Colonoscopy</b>		
Polypectomy	12 (46.1)	12 (48.0)
Biopsy	22 (84.6)	18 (72.0)

**Table 1:** Socio-demographic and pre-anaesthetic data.

Time of onset of caudal block after injection (caudal anaesthesia onset time), caecal intubation time and duration of procedure and sensory block in the two groups are shown in Table 2. There were statistically difference in the mean caecal intubation time ( $p=0.03$ ) and duration of procedure,  $p=0.02$ .

Variables	Group A (N=26) mean $\pm$ SD	Group B (N=25) mean $\pm$ SD	t-test	p-value
Caudal Anaesthesia Onset time (min)	11.7 $\pm$ 4.3	13.5 $\pm$ 4.9	1.46	0.15
Caecal intubation time (min)	21.2 $\pm$ 3.5	12.6 $\pm$ 6.7	2.22	0.03*
Procedural duration (Min)	34.2 $\pm$ 9.9	28.0 $\pm$ 8.7	2.49	0.02*
Duration of sensory block (min)	38.5 $\pm$ 9.7	35.8 $\pm$ 10.8	0.99	0.33

\* - Significant at 0.05

**Table 2:** Clinical data of patients in group A and B.

Procedural Stages	Group	Median score	$\leq$ Median score N (%)	$>$ Median score N (%)	p-value
Pre-procedure	A	3	12 (46.2)	14 (53.8)	0.592
	B	0	13 (52.0)	12 (48.0)	
Insertion	A	0	17 (68.0)	9 (32.0)	0.114
	B	0	21 (84.0)	4 (16.0)	
Splenic flexure	A	2	14 (53.8)	12 (46.2)	0.285
	B	3	12 (48.0)	13 (52.0)	
Hepatic Flexure	A	5	10 (38.5)	16 (61.5)	0.031
	B	3	17 (68.0)	8 (32.0)	

**Table 3:** Median NPRS at different procedural stages in both groups.

### Height of block

While sensory block was obtained at the S3 segment in both groups before colonoscopy, there was anaesthesia progression to S2 segment in 20 patients each in group A (76.9%) and in group B (80%) at the end of colonoscopy. At one-hour post-colonoscopy, the anaesthetic effect regressed to S5 segment; this marked the offset of sensory blockade in groups A and B.

### Pain score

Before the procedure (Pre-procedure), some patients had anal pain and hence pre-procedure pain score was obtained in all patients. The pre-procedure pain scores are shown in Table 3. Median pain scores are found 0 in group A and 0 in group B at insertion of the colonoscope, and 2 in group A and 3 in group B while navigating the splenic flexure. But p-values are 0.114 and 0.285 respectively. The median pain score at the hepatic flexure of group A was 5; which was significantly higher compared to group B which was 3,  $p=0.031$ . About

61.5% of the patients had pain score greater than the median in group A, while 32.0% of the patients in group B had pain score greater than the median at the hepatic flexure. About one-third, 34.62% of the patients in group A and 16% of the patients in group B had rescue analgesia.

Variables	Group A (n=26) Mean $\pm$ SD	Group B (n=26) Mean $\pm$ SD	p-value
<b>Heart rate</b>			
Baseline	79.4 $\pm$ 12.8	75.3 $\pm$ 12.9	0.93
@ 15 min	80.5 $\pm$ 13.6	96.3 $\pm$ 7.2	0.03*
@ 20 min	97.4 $\pm$ 2.5	98.9 $\pm$ 1.0	1.55
@ 30 min	81.7 $\pm$ 8.1	78.5 $\pm$ 13.2	0.07
PACU	84.5 $\pm$ 12.7	77.1 $\pm$ 13.3	0.67

Blood pressure			
Baseline	93.6 ± 15.4	87.7 ± 13.3	0.694
@ 15 min	92.5 ± 20.6	87.7 ± 13.1	0.055
@ 20 min	89.8 ± 20.6	84.4 ± 16.4	0.035*
@ 30 min	87.5 ± 14.1	89.4 ± 15.0	0.676
PACU	83.9 ± 27.8	88.3 ± 23.4	0.97
Key: PACU – Post-Anaesthesia Care Unit			
*Significant at 0.05			

**Table 4:** Trend in blood pressure and heart rate changes.

The trend of blood pressure and heart rate (SpO<sub>2</sub>) changes in both groups are as shown in Table 4.

### Adverse effects

There was demonstrable hip flexion weakness (modified Bromage 4) in 5 patients, (2 in group A and 3 in group B) as shown in Table 5. However, the weakness has resolved at the time of discharge, one hour after the procedure. Of the 26 patients in group A, 10 (38.5%) expressed satisfaction with the procedure while 19 (76%) expressed satisfaction in group B. At one hour after the procedure, all the patients were home ready with a PADSS score of 9 or more.

Variable	A N=26 n (%)	B N=25 n (%)	p-value
<b>Rescue Analgesia</b>			
Intravenous midazolam and fentanyl	9 (34.6)	4 (16.0)	0.199
<b>Modified Bromage Score</b>			
5	24 (92.3)	22 (88)	
4	2 (7.7)	3 (12)	0.668
<b>Sedation Score (Ramsay)</b>			
I	3 (11.5)	0 (0.0)	
II	2 (7.7)	0 (0.0)	
III	4 (15.4)	4 (16.0)	0.164
<b>Patients' Level of Satisfaction (Likert Scale)</b>			
Satisfied	10 (38.5)	19 (76.0)	
Neutral	16 (61.5)	4 (16.0)	
Dissatisfied	0 (0)	2 (8.0)	0.003

**Table 5:** Rescue analgesia, sedation score, modified bromage score and patients' level of satisfaction.

### Discussion

This study demonstrated that caudal anaesthesia is a useful anaesthetic technique in ambulatory colonoscopy as shown by the overall caecal intubation rate of 96.2% and shortened caecal intubation

time particularly in the fentanyl-lidocaine group. Wong et al. [6] reported similar success rate of 95.9%, based on post-operative patients' satisfaction and the need for rescue analgesia. Likewise, Adebamowo et al. [4] and Takure [5] in separate studies, reported a 95% and 99% successful local anaesthetics injection in the caudal space. In this study, the evidence of correct needle placement and injection of LA into the caudal space was supported by the clinical effect of injected drug. This method allowed for early identification of patients with failed block unlike the use of postoperative measure of satisfaction.

Although there was no statistical difference in the duration of sensory block, the quality of analgesic effect of caudal fentanyl-lidocaine was superior compared to caudal saline-lidocaine as shown by the reduction in the median pain scores at all the stages of colonoscopy. The number of patients that received rescue fentanyl and midazolam in both groups showed that, fewer patients required additional pain relief measure in the fentanyl and lidocaine group. Perhaps this may be explained by the conclusion drawn from the study by Hong et al. [7] that using fentanyl as an epidural adjunct produced a better visceral pain relief. One of the possible mechanisms is the synergistic inhibitory effect of fentanyl on nerve conduction not mediated by opioid receptors [8].

Multiple pain transmission pathways due to colonic distension from gas/fluid insufflation may not be completely blocked using caudal anaesthesia technique and this may have impacted greatly on patient's pain perception.

Accelerating the speed of onset of block was believed to be a significant factor amongst others in ambulatory surgical procedures with respect to timely onset of sensory blockade. In this study there was no significant difference in the onset of caudal anaesthesia in the two groups similar to the findings of Hong et al. [7].

Caecal intubation rate is an important indicator of the quality of colonoscopy [9]. In this study; the caecal intubation rate was 100% in the fentanyl-lidocaine group in and 92.3% of the patients in the saline-lidocaine group. These results were comparable to that of Takagi et al. [1]. In the same vein; Bleiberg et al. [10] achieved a caecal intubation rate of 93.1% using lumbar epidural analgesia. According to the recommendations of the United States Multi-Society Task Force on the diagnosis of colorectal cancer, rates above 90% [11] for all colonoscopies and above 95% [5] for screening colonoscopies was recommended. The caecal intubation rate achieved in this study implied that the detection rate of colorectal cancer can be improved upon whenever, unbearable painful discomfort is the rate limiting condition to achieve a satisfactory result [1,10].

While most reported endoscopy, as well as in colonoscopy are done under intravenous conscious sedation, the use of caudal epidural analgesia has rarely been reported. According to the national survey reports of American Society of Gastroenterologist, the most common complication associated with the use of sedatives and analgesic agents for providing pain relief during gastrointestinal endoscopy are cardiorespiratory adverse events [12]. However, in this study the heart rate and blood pressure changes were minimal. There were reported incidences of early difficulty in standing after the procedure (immediately after colonoscopy). Two patients from the saline-lidocaine group and three patients from the fentanyl-lidocaine group experienced difficulty in standing immediately after colonoscopy because they had some degree of motor block. However, this had

resolved by one hour after colonoscopy and the participants were home ready.

A particular need has been identified to establish criteria to assess patients' home readiness given the increasing frequency of day case procedure [13]. In this study, the Post Anaesthetic Discharge Scoring System (PADSS) was employed. All the patients in both groups attained a score of 9 or more at discharge.

## Conclusion

Caudal lidocaine with adjunctive fentanyl provided a superior analgesia which resulted in a shortened caecal intubation time and reduced the need for rescue analgesia in more patients compared to lidocaine alone.

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