



A PROSPECTIVE COMPARATIVE STUDY BETWEEN TUMESCENT AND CONVENTIONAL DISSECTION OF CALOT TRIANGLE IN LAPAROSCOPIC CHOLECYSTECTOMY AT A TERTIARY CARE HOSPITAL IN GANGTOK SIKKIM

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Abstract: Background: The gallbladder is a partially intraperitoneal structure that lies attached to the undersurface of the liver on segments IVB and V. **AIM:** The objective of the study is to compare the duration of the surgery between tumescent or conventional dissection of Calot's triangle dissection during laparoscopic cholecystectomy. **METHODOLOGY:** The study was conducted in the Department of General Surgery at Central Referral Hospital, a 500-bedded tertiary care teaching hospital associated with Sikkim Manipal Institute of Medical Sciences. **RESULT:** The tumescent laparoscopic cholecystectomy group demonstrated significantly easier and faster dissection of Calot's triangle compared to the conventional group, although the overall duration of surgery, intra-operative blood loss, adhesions, gallbladder perforation, bile spillage, and other intra-operative parameters showed no statistically significant differences between the two groups. The study findings suggest that the tumescence technique improves operative ease during Calot's triangle dissection without increasing intra-operative or post-operative complications, despite some degree of anatomical distortion observed intra-operatively. **CONCLUSION:** The use of tumescence in laparoscopic cholecystectomy significantly facilitated and reduced the duration of Calot's triangle dissection, although it caused some distortion of the local anatomy without affecting the overall operative time. Further large-scale studies are required to validate the effectiveness and safety of the tumescence technique in improving surgical dissection during laparoscopic cholecystectomy.

Keywords: Tumescent dissection, conventional dissection, laparoscopic cholecystectomy

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INTRODUCTION

The gallbladder is a partially intraperitoneal structure that lies attached to the undersurface of the liver on segments IVB and V¹. It is 7 to 10 cm in length, holds 30 to 60 mL of bile as a reservoir, and is divided into neck, infundibulum with Hartmann pouch, body, and fundus.² On the side of the gallbladder that is attached to the liver, there is no peritoneal covering; a fibrous lining known as the cystic plate occupies this space. Bile is drained via a cystic duct to the common bile duct (CBD). The gallbladder is being suspended by the fundus to expose the infundibulum and porta hepatis³. Cholelithiasis is the most common disease of gallbladder and biliary tree, affecting 10% to 15% of the population. Similarly, Sikkim also has a high prevalence of cholelithiasis.¹ Gallstones are generally classified into two major subtypes, cholesterol and pigment stones, depending on the principal solute that precipitates into a stone.⁴ Four major factors explain most gallstone formation: supersaturation of secreted bile, concentration of bile in the gallbladder, crystal nucleation, and gallbladder dysmotility. The three types of gallstones, cholesterol stones, pigment stones and mixed stones, have different pathophysiology of development. Inadequate contraction of gall bladder or dysfunctional sphincter of Oddi can contribute to suboptimal bile flow and produce transient stasis, prompting stone formation. Gall stones are often asymptomatic but become symptomatic when they obstruct a visceral structure such as a cystic duct.⁵ However, gallstones often remain asymptomatic, only found incidentally on imaging. Cholecystectomy laparoscopic is the treatment of choice for gallstone disease. Laparoscopic cholecystectomy, first done by Muhe in 1985 (using a direct scope) and later in 1987 by Mouret, is one of the most performed general surgery procedures⁶. Laparoscopic cholecystectomy has a 0.1% to 0.5% mortality and 2% to 3% morbidity. Laparoscopic surgery results in smaller incisions, less pain, and shorter hospitalization when compared to traditional open cholecystectomy, which has significantly increased the number of these procedures done worldwide. Use of saline Tumescent in the dissection of calot's triangle has been shown to result

in decreased duration of surgery than the conventional technique⁷. One of the most important among these is meticulous confirmation of Strasberg's critical view of safety. But this can only be achieved after the dissection of the Calot's triangle has been completed. The dissection of the Calot's triangle can be hazardous and difficult in several cases⁸. To minimize this, surgeons use various combinations of sharp and blunt dissection techniques using a plethora of techniques, instruments and power sources. Electro-surgery, ultrasonic dissection and hydro-dissection are a few of these techniques⁹. But this has never been attempted for surgeries of the extra-hepatic biliary apparatus, especially cholecystectomy. Thus, the current study was planned not only to evaluate the feasibility of this technique but also compare it to the conventional method of dissection¹⁰.

AIM

The objective of the study is to compare the duration of the surgery between tumescent or conventional dissection of Calot's triangle dissection during laparoscopic cholecystectomy.

Material And Methods

The study was conducted in the Department of General Surgery at Central Referral Hospital, a 500-bedded tertiary care teaching hospital associated with Sikkim Manipal Institute of Medical Sciences. It is the only teaching hospital in the north-eastern state of Sikkim. The study duration was one year and six months, from June 2022 to December 2023. A prospective randomized comparative study design was adopted. All patients undergoing laparoscopic cholecystectomy during the study period were invited to participate. Patients who provided informed consent were included in the study and randomized accordingly. The inclusion criteria comprised patients undergoing elective laparoscopic cholecystectomy. Exclusion criteria included patients unwilling to provide consent for participation, any deviation from the planned procedure, patients presenting with jaundice, difficult cholecystectomy cases classified as Cuschieri scale grades 3 and 4 or Nassar scale grade 4,

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patients diagnosed with gallbladder malignancy either
pre-operatively or post-operatively, and pregnant

patients.ts

RESULT

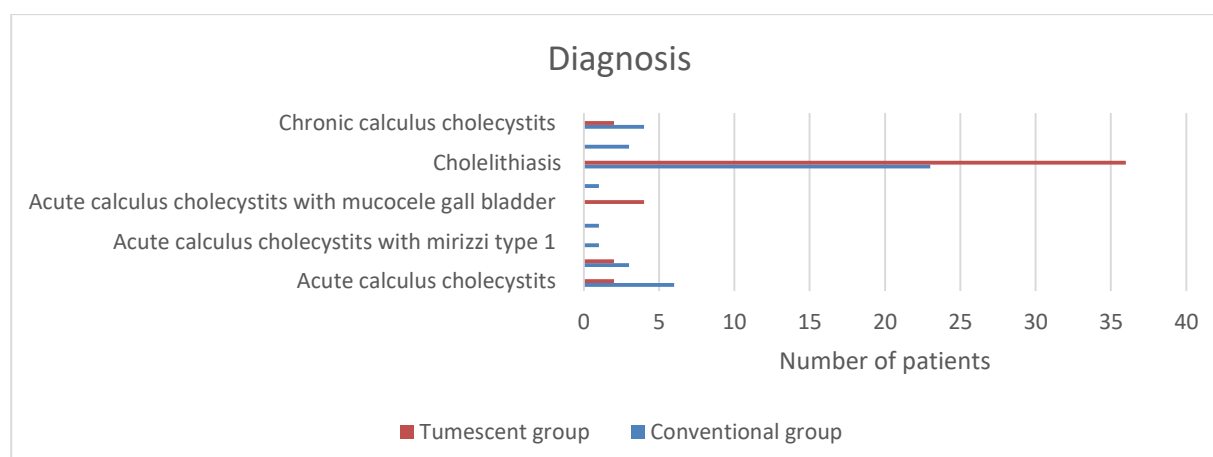
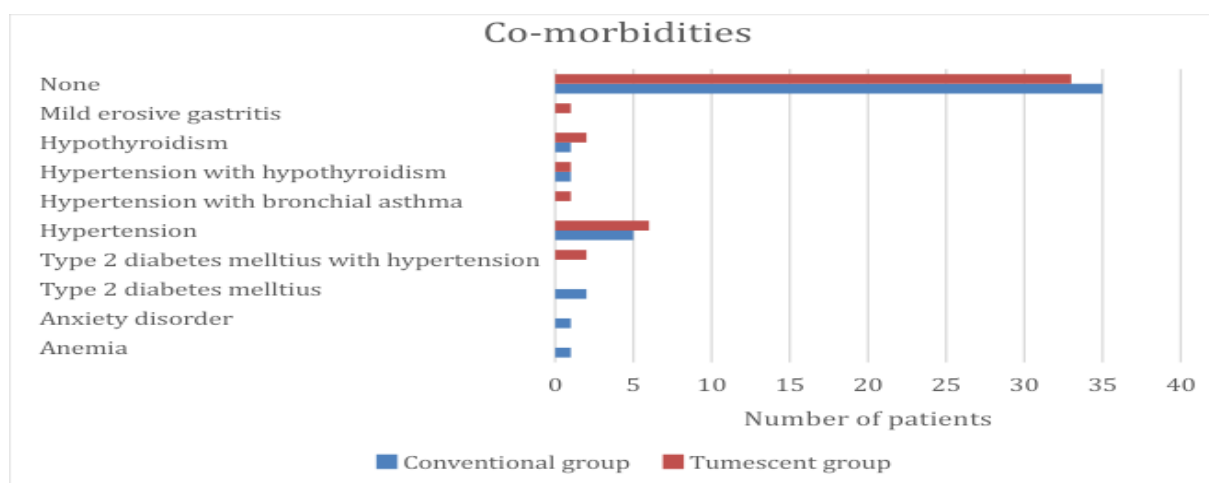
1: Demographic data of patients Age and gender

	Conventional group	Tumescent group	p-value (Independent t-test)
Gender			0.562
Male	6	8	
Female	40	38	
Mean age (years)	37.22±10.22years	39.76±13.27	0.306

The mean age of patients in the conventional laparoscopic cholecystectomy group was comparable to that of the tumescent laparoscopic cholecystectomy group (37.22 ± 10.22 years vs. 39.76 ± 13.27 years; $p=0.306$), with no statistically significant difference observed ($p>0.05$). A total of 14 males and 78 females were included in the study, with male-to-female ratios of 0.15:1 in the conventional group and 0.21:1 in the tumescent group.

2: Co-morbidities and diagnosis

The comorbidities observed in the study included diabetes mellitus, hypertension, anaemia, anxiety disorder, hypothyroidism, bronchial asthma, and mild erosive gastritis. Among the 92 patients, 68 had no comorbidities, while hypertension was the most common comorbidity, accounting for 13.9% of the study population with associated illnesses. The most common diagnosis in both the conventional laparoscopic cholecystectomy group and the tumescent laparoscopic cholecystectomy group was cholelithiasis, accounting for 25% and 39.13% of cases respectively.



3: Laboratory investigations

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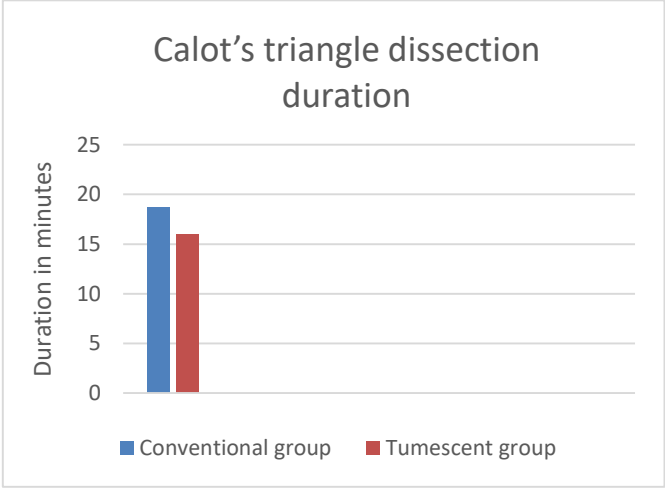
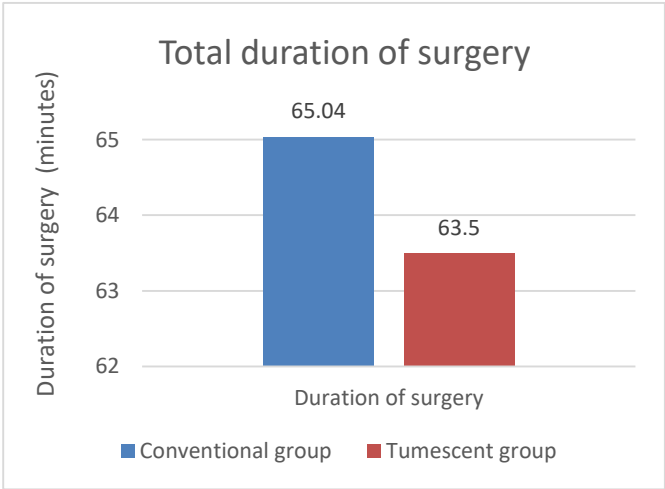
The mean haemoglobin levels, total leukocyte count, serum total bilirubin, and alkaline phosphatase values were comparable between the conventional and tumescent laparoscopic cholecystectomy groups, with no statistically significant differences observed ($p>0.05$).

Laboratory parameter	Mean in conventional group	Mean in tumescent group	p-value (Independent t-test)
1. Hemoglobin(gm/dl)	12.804±1.563	12.800±1.670	0.990
2.White blood cells($\times 10^3$)	7.192±1.818	6.525±1.774	0.078
3.Total bilirubin(mg/dl)	0.709±0.325	0.69±0.337	0.871
4.Alkaline phosphatase(U/L)	103.33±29.580	105.3±36.137	0.768

Along with the laboratory investigations, several other parameters such as the time since the last abdominal pain, USG findings such as gall bladder wall thickness, common bile duct diameter, gall bladder sludge, number of gall stones, pericholecystic fluid were also evaluated. $p>0.05$ for comparison of above parameters between conventional and tumescent group depicted that the difference was statistically insignificant. Several clinical parameters such as icterus, abdominal tenderness, fever and murray's sign were same in both the groups.

4: Intra-operative blood loss, total duration of surgery and Calot's triangle dissection time.

	Mean in conventional group	Mean in tumescent group
Duration of surgery(minutes)	65.04±27.238	63.50±22.363
Calot's triangle dissection duration(minutes)	18.65±6.447	15.96±4.633
Intra-operative blood loss(ml)	11.30±21.33	8.20±8.041



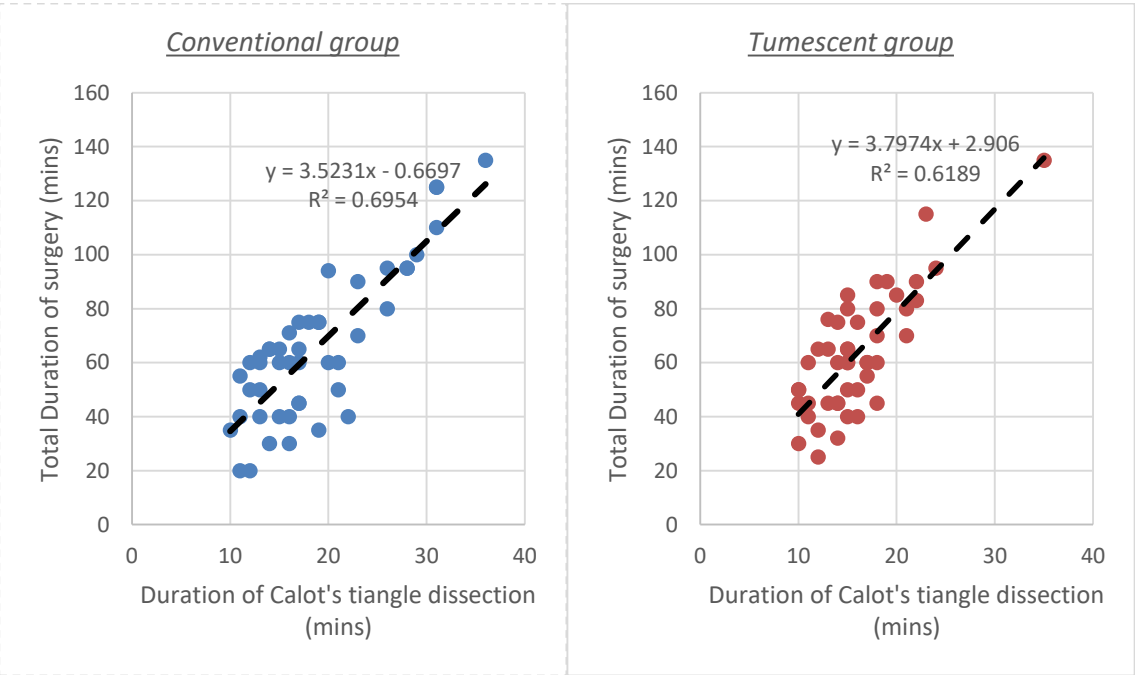
The average estimated blood loss and mean duration of surgery were lower in the tumescent laparoscopic cholecystectomy group compared to the conventional group; however, these differences were not statistically significant ($p>0.05$). p -value for intra-operative blood loss was 0.358 and for duration of surgery was 0.767. In contrast, the mean duration of Calot's triangle dissection was significantly shorter in the tumescent group (15.96 ± 4.633 minutes) compared to the conventional group (18.65 ± 6.447 minutes), with a statistically significant p -value of 0.024.

5: Calot's triangle dissection vs total duration of surgery

The mean time taken in calot's triangle dissection duration in both groups was 17.30 ± 5.745 minutes and the mean duration of total surgery in both groups was 64.27 ± 24.795 . There was a statistically significant

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difference between the two parameters with Pearson correlation with a p-value of 1.460×10^{-21} .

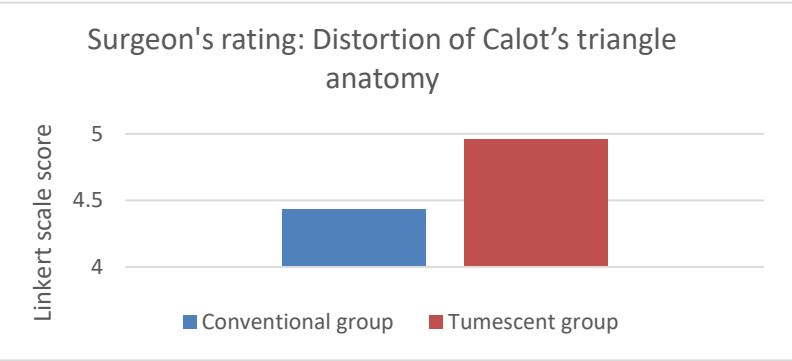
Study parameter	Mean duration(minutes)	p-value
Calot's triangle dissection duration	17.30±5.745	1.460x10 ⁻²¹
Total duration of surgery	64.27±24.795	



6: Distortion of Calot’s triangle anatomy

Distortion of Calot’s triangle anatomy	Mean in conventional group	Mean in tumescent group	p-value (Independent t-test)
	4.43±1.088	4.96±1.54	0.028

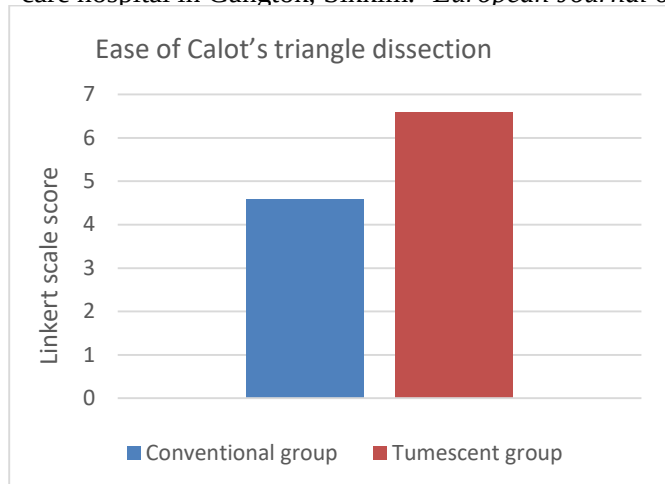
Based on the Linkert scale values, the mean value of distortion of Calot’s triangle anatomy in the conventional group was 4.43 ± 1.088 and 4.96 ± 1.54 in the tumescent group. The difference was statistically significant with a p-value of 0.028.



7: Ease of Calot’s triangle dissection

At the end of surgery, surgeons were asked to rate ease of dissection of calot’s triangle dissection on a Likert scale of 1-10. Based on the Linkert scale values, mean value of ease of Calot’s triangle dissection in conventional group was 4.59 ± 1.423 and 6.59 ± 1.543 in tumescent group. The difference was statistically significant with a p-value of 5.188×10^{-9} .

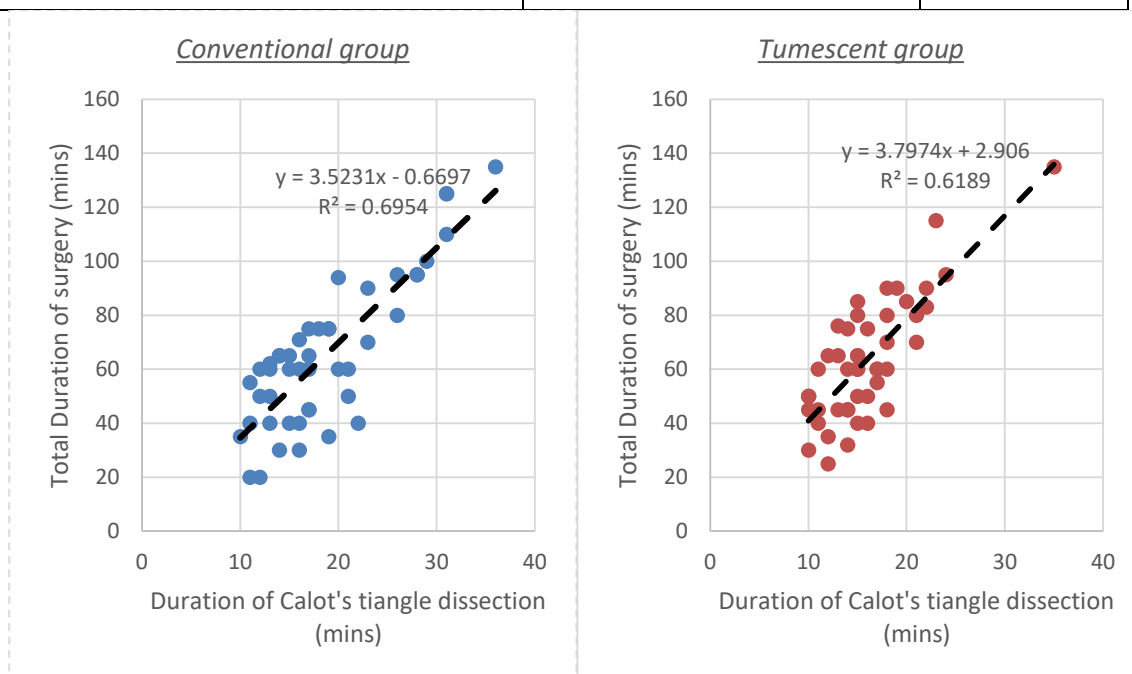
Ease of Calot’s triangle dissection	Mean in conventional group	Mean in tumescent group	p-value (Independent t-test)
	4.59±1.423	6.59±1.543	5.188x10 ⁻⁹



8: Calot's triangle dissection vs total duration of surgery

The mean time taken in calot's triangle dissection duration in both groups was 17.30 ± 5.745 minutes and the mean duration of total surgery in both groups was 64.27 ± 24.795 . There was a statistically significant difference between the two parameters with Pearson correlation with a p-value of 1.460×10^{-21} .

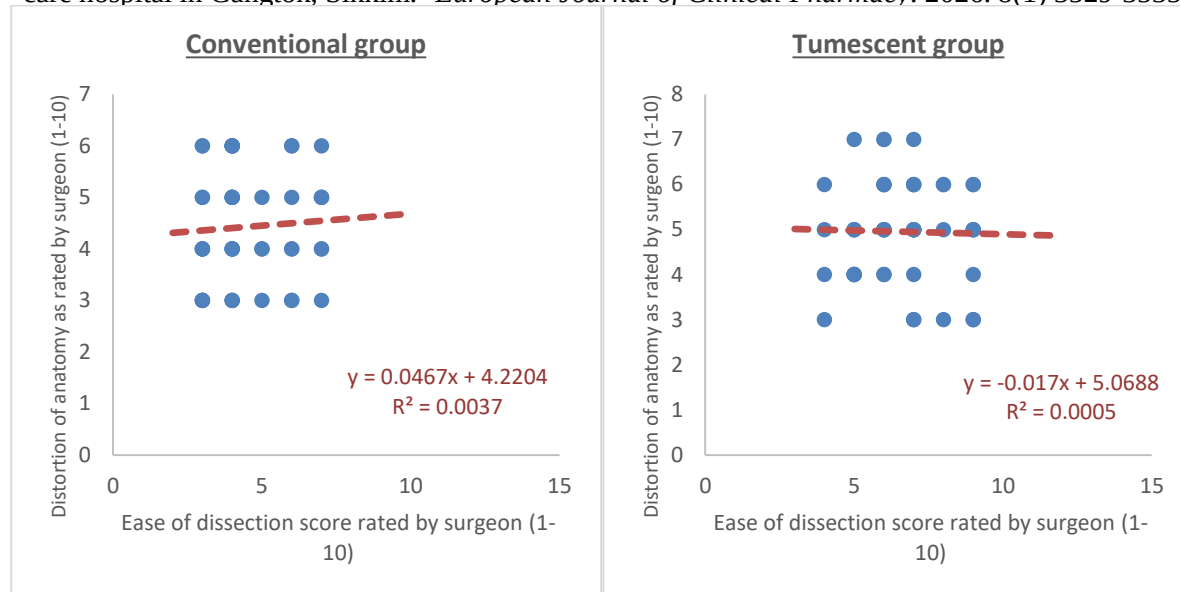
Study parameter	Mean duration(minutes)	p-value
Calot's triangle dissection duration	17.30 ± 5.745	1.460×10^{-21}
Total duration of surgery	64.27 ± 24.795	



9: Ease of dissection versus distortion of anatomy

The subjective assessment of ease of dissection and distortion of anatomy rated by the operating surgeon were compared using Pearson correlation

In the conventional group these scores appeared to be positively correlated, but having no statistical significance. On the other hand when data from tumescence group was analyzed, a negative correlation was found; albeit all the correlations being statistically insignificant with p value > 0.05 .



	Conventional group	Tumescent group
Pearson Correlation	0.061127	-0.02279
p-value (2-tailed)	0.686542	0.880496

The implication if this finding is that in conventional dissection, a undistorted anatomy corresponds to easy dissection. On the other hand, tumescence induced ease of dissection in is also associated with a correspondingly increased distortion of anatomy.

Other intra-operative parameters such as intra-operative adhesions, difficulty grade of cholecystectomy laparoscopy - Cuschieri scale, intra-operative gall bladder perforation, Intra-operative bile spillage, intra-operative stone spillage, intra-operative lignocaine use were statistically insignificant with p-value more than 0.05.

Post-operative parameters- post-operative nausea and vomiting, post-operative shoulder tip pain, post-operative abdominal pain, post-operative pulse rate and mean arterial pressure, post-operative dyspnoea and the day of discharge was also statistically insignificant with p-value more than 0.05.

DISCUSSION

The mean age of this study population was 37.22 and 39.76 years in group 1 and 2 respectively, which was not significant, this finding is also similar to the previous study conducted in our hospital where the mean age was 37.09 years. The male to female ratio was 0.15:1 and 0.21:1 in group 1 and 2 respectively. This also aligns with the well-established predominance of gallstone disease in females, attributed to estrogenic activity that increases cholesterol concentration in bile, leading to stone formation.

The co-morbidities observed in the study population were documented, with hypertension being the most prevalent, followed by diabetes mellitus and hypothyroidism. Prior research has shown a connection between diabetes mellitus, dyslipidaemia, metabolic syndrome, and gallstone disease. A study from North India identified gallstone disease as a lifestyle disorder, establishing its association with diabetes mellitus, hypertension, and hypercholesterolemia. Additionally, recent studies have indicated that hypothyroidism can lead to secondary hypercholesterolemia, thereby increasing

the risk of gallstone formation. No similar studies were done in the past which could evaluate the comparison of pre-operative parameters like haemoglobin, total leukocyte count, serum bilirubin and alkaline phosphatase in tumescent cholecystectomy laparoscopic. The difference was not significant in pre-operative blood and USG abdomen parameters in this study.

In this study, we compared our findings with those from other surgical fields where tumescence has been applied successfully. In the discussion section of our thesis, we observed a statistically significant difference in the ease of calot's triangle dissection between the two groups with a Linkert scale score of 4.59 in group 1 and 6.59 in group 2. This finding suggests that the technique applied to group 2 had a notable impact on the dissection process. It was noted that while the tumescence group benefited from an easier dissection process, there was a corresponding increase in the distortion of Calot's triangle anatomy with p value of 0.028. This distortion is a significant finding as it may complicate the identification of crucial structures during surgery, potentially increasing the risk of complications but there was no statistically significant complication noted in our study groups intra-

Operative Gyite and Mahipso, M, Rat Nislyant, T, Ke, E, use sh of S. A., & Yashwanthiga N. A prospective comparative study technique for dissecting difficult anatomy in Calot's triangle in laparoscopic cholecystectomy. *Calot's triangle with improved delineation of crucial anatomical structures.* Rethinasamy et al.¹² demonstrated the successful application of the tumescent technique in the excision of refractory arteriovenous malformations. Vascular Surgery The study reported that the use of tumescence eliminated the need for preoperative embolization and drastically reduced intra-operative blood loss, thereby facilitating safer surgical excision with improved operative outcomes.

In comparison it was noted that the total duration of surgery did not show statistically significant difference between the two groups with total time of 65.04 minutes and 63.50 minutes in conventional and tumescent groups respectively. While on the other hand there was a statistically significant reduction in the duration of Calot's triangle dissection in the tumescent group with a p-value of 0.024. The mean duration of Calot's triangle dissection was 18.65 in the conventional group and 15.96 minutes in the tumescent group. This suggests that the tumescence technique specifically enhances efficiency in the dissection of a calot's triangle, even though it does not affect the overall duration of surgery. Intra-operative adhesions noted in 23.92% in Group 1 and 17.39% in Group 2.

Intra-operative cuschieri difficulty grade was 1 in 50% group 1 and 67.39% in group 2, cuschieri grade 2 was noted in 50% group 1 and 32.60 group 2 participants respectively.

Intra-operative gall bladder perforation and bile spillage were 32.60% and 34.78%, 28.26% and 26.08% in group 1 and 2 respectively. Stone spillage was present in 10.86% and 2.17% in group 1 and 2 respectively.

Intra-operative mean blood loss was 11.30ml and 8.20ml in group 1 and 2 respectively.

There was no statistically significant difference noted between the two groups.

CONCLUSION

Based on the findings of this study, it was observed that the use of tumescence significantly facilitated the dissection of Calot's triangle. However, there was a noted distortion of the anatomy of Calot's triangle upon visualization following the application of tumescence. The study indicated that the instillation of tumescence in the sub-serosal plane of Calot's triangle resulted in a considerable reduction in the time required to dissect this anatomical area. Despite this improvement, the total duration of the procedure remained unaffected. But further studies need to be done with a larger sample size to validate this.

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