



<https://doi.org/10.34883/PI.2024.13.2.031>



Abdulmajeed M.U.¹✉, Jasim H.A.¹, Katoof F.M.²

¹ Al-Mustansiriya University, Baghdad, Iraq

² Al-Yarmok Teaching Hospital, Baghdad, Iraq

Comparison Study between Laparoscopic Hem-o-lok Clipping Versus Open Vicryl Knotting of Appendiceal Stump Closure

Conflict of interest: nothing to declare.

Authors' contribution: Abdulmajeed M.U. – conceptualization, methodology, software, validation, investigation, resources, data curation, writing – review & editing, visualization, supervision; Jasim H.A. – conceptualization, methodology, software, validation, investigation, resources, data curation; Katoof F.M. – conceptualization, methodology, software, validation, investigation, resources, data curation, writing – original draft, writing – review & editing, visualization, supervision. The article is published in the author's edition.

Submitted: 11.01.2024

Accepted: 18.03.2024

Contacts: ahmedsalihdr2008@yahoo.com

Abstract

Introduction. Acute appendicitis is the most common emergency general surgical procedure. Appendectomy done by open and laparoscopic methods. Many method for closure appendiceal stump closure such as pre tied endoloop, titanium clipping, Hem-o-lok, intracorporeal knotting and linear staplers, but still there is a debate which one is better. one type of clips are the polymeric clips (Hem-o-lok) which consist of non-conductive, inert, non-absorbable substance and can secure the blood vessel up to 16 mm.

Purpose. To assess the safety and efficacy of Hem-o-lok for appendiceal stump closure.

Materials and methods. In this a retrospective study, we examine a 90 cases who underwent appendectomy, 30 cases underwent laparoscopic appendectomy, the appendiceal stump closed by Hem-o-lok (test group), 60 cases did open appendectomy, the appendiceal stump closed by classical vicryl knotting (control group). This study done in Al-Yarmok Teaching Hospital and Al-Arabi private Hospital from October 2019 till October 2021.

Results. A total 90 cases involved in our study, Most of patients between 20–29 years in both groups. The mean operative time was statically significant in duration of surgery were less than 30 minutes in 23 (76.7%) in laparoscopic group in compare with open group which were 27 within 30 min. Some of the patient that did surgeries need drain which were more in laparoscopic group 12 (40%) versus 10 cases were left a drain in control group (statically was significant). There were only one patient (3.3%) develop fluid collection and clip slipping in compare to 4 (6.7%) in classical group.

Conclusion. The Hem-o-lok clip is safe and effective in appendiceal stump closure.

Keywords: acute appendicitis, appendectomy, titanium clipping, Hem-o-lok, intracorporeal knotting, linear staplers

Абдулмджид М.У.¹✉, Джасим Х.А.¹, Катуж Ф.М.²

¹ Университет Аль-Мустансирия, Багдад, Ирак

² Учебная больница Аль-Ярмок, Багдад, Ирак

Сравнительное исследование лапароскопического клипирования культи аппендикса с помощью зажима Hem-o-lok и ее закрытия открытым методом с помощью перевязывания викрилом

Конфликт интересов: не заявлен.

Вклад авторов: Абдулмджид М.У. – концепция, методология, программное обеспечение, проверка результатов, проведение исследования, ресурсы, обработка данных, написание, рецензирование и редактирование текста, визуализация, научное руководство; Джасим Х.А. – концепция, методология, программное обеспечение, проверка результатов, проведение исследования, ресурсы, обработка данных; Катуж Ф.М. – концепция, методология, программное обеспечение, проверка результатов, проведение исследования, ресурсы, обработка данных, написание черновика, рецензирование и редактирование текста, визуализация, научное руководство.

Статья опубликована в авторской редакции.

Подана: 11.01.2024

Принята: 18.03.2024

Контакты: ahmedsalihdr2008@yahoo.com

Резюме

Введение. Острый аппендицит является наиболее распространенной неотложной общехирургической операцией. Аппендэктомия выполняется открытым и лапароскопическим способами. Существует несколько методов закрытия культи аппендикса, включая эндолюп, клипирование титановой клипсой, зажимы Hem-o-lok, интракорпоральные узлы и линейные степлеры, однако до сих пор не установлено, какой из них предпочтительнее. Одним из видов клипс являются полимерные клипсы (Hem-o-lok), которые изготавливают из непроводящего инертного нерассасывающегося вещества. С их помощью можно фиксировать кровеносные сосуды диаметром до 16 мм.

Цель. Оценить безопасность и эффективность зажима Hem-o-lok для закрытия культи аппендикса.

Материалы и методы. В данном ретроспективном исследовании обследовано 90 пациентов, перенесших аппендэктомию. 30 пациентам была проведена лапароскопическая аппендэктомия с закрытием культи аппендикса с помощью зажима Hem-o-lock (контрольная группа), 60 пациентов перенесли открытую аппендэктомию, при которой культю аппендикса закрывали классическим викриловым узлом (контрольная группа). Исследование проводилось в учебной больнице Аль-Ярмок и частной больнице Аль-Араби с октября 2019 по октябрь 2021 г.

Результаты. Всего в исследовании приняли участие 90 пациентов, в обеих группах преобладали пациенты в возрасте 20–29 лет. Средняя продолжительность хирургического вмешательства была статистически значимой и составляла менее 30 минут у 23 (76,7%) пациентов в лапароскопической группе по сравнению с группой открытой аппендэктомии, в которой было 27 операций продолжительностью в пределах 30 минут. Некоторым пациентам требовалась установка дренажа, таких пациентов было больше в лапароскопической группе – 12 (40%) по сравнению с 10 случаями



установки дренажа у пациентов контрольной группы (статически значимые показатели). Только у одного пациента (3,3%) из группы лапароскопической аппендэктомии наблюдалось скопление жидкости и соскальзывание клипс, тогда как в группе открытой аппендэктомии таких случаев было 4 (6,7%).

Заключение. Применение зажима Hem-o-lok является надежным и эффективным способом закрытия культи аппендикса.

Ключевые слова: острый аппендицит, аппендэктомия, титановые клипсы, Hem-o-lok, интракорпоральное завязывание узлов, линейные степлеры

■ INTRODUCTION

Acute appendicitis is the most common emergency general surgical procedure, more than 25% of emergency hospital admissions and more than 40% of emergency laparotomies. Appendectomy done by open and laparoscopic methods. First laparoscopic appendectomy described by Semm in 1983. Many articles described the advantages of laparoscopic approach in addition good diagnostic method specially in the female [1].

At the time being more than half of these cases laparoscopically done, many systemic reviews shown decrease the postoperative pain, surgical site infection faster recovery and early return to the their works but increase intra-abdominal abscess [2].

Many method for closure appendiceal stump closure such as pre tied endoloop, titanium clipping, Hem-o-lok, intracorporeal knotting and linear staplers, but still there is a debate which one is better [1].

A surgical clips very widely used to ligate small and large vessel and tissue. First time used by Harvy Cushing in 1908 sliver clips, later forbidden usage due to severe inflammatory reaction. Then newer clips, stainless steel, newer materials such as titanium replaced sliver types. There many drawback of metal based clips usage like poor holding power, dislodgement from a vessel or structure, foreign body and inflammatory reaction. Metal based clips may shows scatter artifacts more in tantalum clips, followed by stainless steel clips, less in titanium clips, five metallic clips showing ferromagnetic properties (iron, cobalt, nickel, gadolinium, and dysprosium) and may have torque motion whenever pass in strong magnetic field, although torque motion less with titanium clips (these have no ferromagnetic properties), image artifacts in MRI will happen [3].

Titanium clips has problem of intraoperative or late slipping and may cause serious complications. Many surgeons may use two or three clips to in the appendiceal stump to avoid these problem [4].

Some author tried to study the effectiveness of double shanks titanium clips (DS-clips) provide more safety for slipping and prevent clip scissoring [5].

Another type of clips are the polymeric clips (Hem-o-lok) which consist of non-conductive, inert, non-absorbable substance and can secure the blood vessel up to 16 mm. The has hinged locking mechanism with integrated teeth which prevent slippage, it is non-metallic, can be used safely with electrocautery without risk of current spread, other advantages is cost effective. There are disadvantages of this kind which is clipping of severe inflammation of the base of appendix with diameter larger than

16 mm size can be encompassed by the clips. Another problem is clip migration, that is commonest complication, other theoretical problems which is chronic pain, granuloma or foreign bodies can happen within 3 months postoperatively [6].

■ PURPOSE OF THE STUDY

To assess the safety and efficacy of Hem-o-lok for appendiceal stump closure.

■ MATERIALS AND METHODS

in this a retrospective study, we examine a 90 cases who underwent appendectomy, 30 cases underwent laparoscopic appendectomy, the appendiceal stump closed by Hem-o-lok (test group), 60 cases did open appendectomy, the appendiceal stump closed by classical vicryl knotting (control group).this study done in Al-Yarmok Teaching Hospital and Al Arabi private Hospital from October 2019 till October 2021.during these two years, those patients attend emergency department with sigh and symptoms with acute appendicitis, All patients suspected appendicitis sent for CBC, Blood urea and serum creatinine, GUE, and emergency ultrasound study All patients discuss with them the methods of appendectomy and take the informed consent.

Exclusion criteria

- 1 – those with uncertainty of diagnosis.
- 2 – those with grossly normal looking appendix intraoperatively.
- 3 – those loss their follow up.
- 4 – those above 60 years or less than 10 years.

Laparoscopic appendectomy done under GA with the standard three ports, verres needle with CO2 insufflation in supine position primary 10mm camera ports, right leg up position another right hypochondrial 10mm port for laparoscopic clipper third port was 5mm in the left iliac fossa. The Hemo clips was X-Large clips. The procedure done after identification of the appendix using non traumatic bowel grasper in left hand with one of the energy sources (Hook, spatula, Harmonic scalpel, Ligasure) for securing the mesoappendix in the right hand, after complete releasing of the appendix, using two Hemo clips for the Base, third clips was in the specimen side using metallic clips, extraction of the appendix through 10 mm port. Washing and suction with saline. Some patients need drain and inserted as left pelvic drain (see Figures). Classical open appendectomy done in supine position. Grid iron incision, the wound open in layer, identification of the appendix, ligation of mesoappendix. The appendiceal stump closed by vicryl suture 2/0 double ligature. Then complete appendectomy. Some patients need right pelvic drain, closure in layer, skin closed.

The data collected for age, gender, medical illness, obesity, the intraoperative data recorded include the mean operative time, intraoperative macroscopic appearance of the appendix and classified as (inflamed, gangrenous, perforated, normal), if associated with other pathology like ovarian cyst, gall stones), those need drain insertion. Postoperative data recorded include time of removal drain, postoperative complications include slipping of clips or ligature causing bleeding or bowel content leak also fluid collection or abscess. in addition recording the time of discharge from hospital.



Statistical analysis

Analysis of data was carried out using the available statistical package of SPSS-27 (Statistical Packages for Social Sciences – version 27). Data were presented in simple measures of frequency, percentage, mean, standard deviation, and range (minimum-maximum values). The significance of difference of different means (quantitative data) were tested using Students-t-test for difference between two independent means. The significance of difference of different percentages (qualitative data) were tested using Pearson Chi-square test (2-test) with application of Yate's correction or Fisher Exact test whenever applicable. Statistical significance was considered whenever the P value was equal or less than 0.05.

■ RESULTS

A total 90 cases involved in our study. Most of patients between 20–29 years in both groups. Most cases did laparoscopic approach were female 21 cases (70%). While 32 (53%) cases did open method. Two cases (6.7%) had a medical illness in a form of diabetes mellitus in test group while 4 cases were obese patients in control group. As shown in table 1.

The mean operative time was statically significant in the duration of surgery were less than 30 minutes in 23 (76.7%) in laparoscopic group in compare with open group which were 27 within 30 min, 22 cases within 45 min and 10 cases (16.7) equal or more than 60 min the mean operative time is shorter in test group in compare to control group.

The intraoperative finding of this procedure were inflamed in most cases of Hem-o-lock clipping 23 (76.7%) versus 27 (45%) classical vicryl knotting were inflamed the remaining were, 6 (10%) in test, 23 (38.3%) in control group were catarrhal.

Table 1
Basic characters of patients

		Hem-o-lok clipping		Classical Vicryl knotting		P value
		No	%	No	%	
Age (years)	<20years	7	23.3	22	36.7	0.448
	20–29	12	40.0	23	38.3	
	30–39	6	20.0	6	10.0	
	≥40years	5	16.7	9	15.0	
	Mean ± SD (Range)	27.9±11.3 (11–62)		24.9±11.7 (8–64)		0.250
Gender	Male	9	30.0	28	46.7	0.130
	Female	21	70.0	32	53.3	
Medical illness	Hypertension	1	3.3	–	–	–
	Diabetes mellitus	2	6.7	–	–	
	Asthma	1	3.3	–	–	
	No	26	86.7	60	100.0	
Obesity	Yes	–	–	4	6.7	0.148
	No	30	100.0	56	93.3	

Notes: * significant difference between percentages using Pearson Chi-square test (χ^2 -test) at 0.05 level; # significant difference between two independent means using Students-t-test at 0.05 level.

Table 2
Intraoperative events

		Hem-o-lok clipping		Classical Vicryl knotting		P value
		No	%	No	%	
Mean operative time (minutes)	<30min	23	76.7	1	1.7	0.0001*
	30	7	23.3	27	45.0	
	45	–	–	22	36.7	
	≥60 min	–	–	10	16.7	
	Mean ± SD (Range)	25.4±5.4 (18–40)		44.4±10.9 (22–70)		0.0001#
Intraoperative finding perforation or abscess	Catarrhal	6	20.0	23	38.3	0.065
	Inflamed/odematous	23	76.7	27	45.0	
	Gangrenous	–	–	3	5.0	
	Perforated	–	–	1	1.7	
	Normal	1	3.3	6	10.0	
Associated other pathology	Ovarian follicular cyst	7	23.3	9	15.0	0.210
	Gall stones	1	3.3	–	–	
	No	22	73.3	51	85.0	
	Mean ± SD (Range)	31.1±6.9 (20–48)		30.1±11.5 (18–72)		0.685

Notes: * significant difference between percentages using Pearson Chi-square test (c²-test) at 0.05 level; # significant difference between two independent means using Students-t-test at 0.05 level.

Table 3
Postoperative events

		Hem-o-lok clipping		Classical Vicryl knotting		P value
		No	%	No	%	
Drain insertion	Yes	12	40.0	10	16.7	0.015*
	No	18	60.0	50	83.3	
Time of removal of drain (days)	1	1	8.3	1	10.0	0.008*
	2	1	8.3	7	70.0	
	≥ 3 days	10	83.3	2	20.0	
Post-operative slipping of clips/ligature	Yes	1	3.3	–	–	0.155
	No	29	96.7	60	100.0	
Bleeding	Yes	–	–	–	–	–
	No	30	100.0	60	100.0	
Post-operative fluid or abscess collection	Yes	1	3.3	4	6.7	0.515
	No	29	96.7	56	93.3	
Time of discharge from hospital (hours)	< 24hours	1	3.3	5	8.3	0.0001*
	24	12	40.0	37	61.7	
	36	16	53.3	5	8.3	
	≥ 48 hours	1	3.3	13	21.7	
	Mean ± SD (Range)	31.1±6.9 (20–48)		30.1±11.5 (18–72)		0.685

Notes: * significant difference between percentages using Pearson Chi-square test (c²-test) at 0.05 level; # significant difference between two independent means using Students-t-test at 0.05 level.



Most of the patients shown in test group show no other pathology 22 (73.3%), the same for control group 51 (85%), the remaining cases shown other pathology (ovarian cyst, gall bladder stones) were statically not significant as shown un table 2.

Some of The patient that did surgeries need a drain which were more in laparoscopic 12 (40%) in compare to 10 (16.7%) were left in control group, (statistically was significant). This drain need longer time for removal which was more than three days in laparoscopic group 10 (83.3%) versus 2 (20%) in control group. Most of the patient in vicryl knotting had been removed their drains in the second day 7 (70%), p value was significant.

There were only one patient (3.3%) develop fluid collection and clip slipping in compare to 4 (6.7%) in classical group.

Regarding the time of discharge 29 cases (96.7%) of the patient return to their home within 36 hours in contrast to control, 47 cases (78.3%), the remaining 13 cases (21.7%) need more than 48hours to discharge to their home as shown in table 3.

■ DISCUSSION

Laparoscopic Appendicectomy has recently become the gold standard in treatment of acute appendicitis all over the word but in our institution unfortunately open appendectomy remain the standard procedure due to unavailability of the laparoscopic trolly's in the theater in governmental hospital, so most cases by laparoscopic method done in private hospital and we compared with open vicryl knotting not to endoscopic Endo loop vicryl knot.

An important step in appendectomy is securing the appendicular stump, the first one who used the of clips to close the appendicular stump was by Cristalli et al. who use metal clips [7].

In the current study, age and sex of the patients did not shows significant difference in either groups similar to Lars and et al study.

In the current study the mean operative time was significantly reduced and was similar Wilson et al [8] who conclude polymeric clips are a quicker and cheaper method for securing appendiceal stump this is may be due to easier apply on the base of appendix require less skills. Although we are using two Hem-o-lok in base and one specimen part of the appendix, this was opposite Lars Ivo Partecke and et al who use single polymeric clip for close the stump and concluded the use more clips increasing the operative time, stump necrosis and local abscess.

In the present study usage of two clips for more securing the stump, and no appendeal long stump nor necrosis reported and this was similar to Delibegovic and Matovic study who used two clips without any complication or slipping from the base, this study published in 2009 [8].

In the current study the usage of drain and more time for removal in laparoscopic versus open method, our explanation due to recent experience in using Hem-o-lok closure method to prevent any post operative abscess and fluid collection, some cases discharged to home within 24 hours with their drains and removed within 72 hours, this was in acceptance with Wilson and et al who suggested the usage of drains accordance to surgeon preference. Although the current study shown the number of patients discharged from hospital in control group significantly quicker but most cases in both groups discharged 24–27 hours post-surgery [9].

In recent study shown one case developed postoperative abscess collection. This patient was diabetic in the second trimester of pregnancy with previous history of sleeve gastrectomy, previous left open ovarian cystectomy, The intraoperative finding was severe adhesion with appendix in catarrhal stage in association with right ovarian cyst, we did laparoscopic appendectomy and cystectomy, the developed abscess collection, she required readmission, open drainage with covering antibiotic, tocolytic drugs and controlling her sugar and discharged after three days.

Limitation and recommendation:

1. Increasing the sample size.
2. Manufacturing XXL Hem-o-lock to secure base of appendix up 16 mm.
3. Availability of laparoscopy in emergency appendectomy in governmental hospital.

■ CONCLUSION

Current study suggest the Hem-o-lock clip is safe and effective in appendiceal stump closure.

■ REFERENCES

1. Ates M, Dirican A, Ince V, et al. Comparison of intracorporeal knot-tying suture (polyglactin) and titanium endoclips in laparoscopic appendiceal stump closure: A prospective randomized study. *Surgical Laparoscopy, Endoscopy and Percutaneous Techniques*. 2012;22(3):229–31.
2. Rickert A, Bönninghoff R, Post S, et al. Appendix stump closure with titanium clips in laparoscopic appendectomy. *Langenbeck's Archives of Surgery*. 2012;397(2):327–31.
3. National Guideline Centre (UK). Evidence review for management options in failed primary surgery: Hyperparathyroidism (primary): diagnosis, assessment and initial management: Evidence review F. London: National Institute for Health and Care Excellence (NICE); 2019 May. (NICE Guideline, No. 132). Available from: <https://www.ncbi.nlm.nih.gov/books/NBK577898/>.
4. Schenk M, Müller G, Greiner TO, et al. Pull-off characteristics of double-shanked compared to single-shanked ligation clips: An animal study. *Innovative Surgical Sciences*. 2020 Sep 1;1(1):41–6.
5. Rickert A, Krüger CM, Runkel N, et al. The TICAP-Study (titanium clips for appendicular stump closure): A prospective multicentre observational study on appendicular stump closure with an innovative titanium clip. *BMC Surgery*. 2015;15(1):1–9.
6. Reinke CE, Tabone LE, Fong P, et al. Safety and efficacy of polymeric clips for appendiceal stump closure. *Journal of the Society of Laparoendoscopic Surgeons*. 2016;20(3).
7. Partecke LI, Kessler W, Von Bernstorff W, et al. Laparoscopic appendectomy using a single polymeric clip to close the appendicular stump. *Langenbeck's Archives of Surgery*. 2010;395(8):1077–82.
8. Delibegović S. The use of a single hem-o-lok clip in securing the base of the appendix during laparoscopic appendectomy. *Journal of Laparoendoscopic and Advanced Surgical Techniques*. 2012;22(1):85–7.
9. Wilson MSJ, Maniam P, Ibrahim A, et al. Polymeric clips are a quicker and cheaper alternative to endoscopic ligatures for securing the appendiceal stump during laparoscopic appendectomy. *Annals of the Royal College of Surgeons of England*. 2018 Jul 1;100(6):454–8.