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# NEEDLESCOPIC APPENDECTOMY IN PEDIATRIC PATIENTS

By

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## ABSTRACT

**Background:** Acute Appendicitis (AA) is one of the most common surgical emergencies in children. Its spectrum ranges from simple inflammation to gross perforation.

**Objective:** To evaluate the feasibility, safety, efficacy and merits of using "Needlescopic" approach by using instruments have diameter ≤ 2 mm. as suture grasper devices

**Patients and Methods:** Needlescopic appendectomy (NA) accomplished for 40 patients with uncomplicated appendicitis, and attended to the Pediatric Surgery Department of Al-Azhar University Hospitals, in Cairo, Egypt, and Mataria Teaching Hospital during the period from May 2019 to February 2020. We used 18-G epidural needle (EN), Veress needle and a thin homemade insulated long diathermy probe (LDP) without any conventional laparoscopic instruments.

**Results:** NA was attempted in 40 patients equally divided between males and females. Under general anesthesia, the operations were completed without conversion to open appendectomy. Twenty-eight cases were compeleted intra corporeally and 12 cases were completed extra corporeally. Mean operative time was 30.2+4 minutes for intracorporeal and 22.5+ 6 minutes for extra corporeal.

**Conclusion:** NA was safe, easy and minimally invasive with cosmetic advantages over conventional appendectomy.

**Keywords:** Acute Appendicitis, Needlescope, Suture Grasper Devices.

## INTRODUCTION

Appendectomy has been the standard surgical management for appendicitis since McBurney described his technique in 1894 *(Horvath et al., 2017).*

Laparoscopic appendectomy (LA) for appendicitis became the preferable technique for some surgeons because of many surgical advantages including better visualization to the entire abdomen, minimizing the incidence surgical site infection, short hospital stay, less postoperative pain, faster returning to physical activity and significant satisfaction of the patients and families regarding better cosmetic results *(Chandler, 2014).*

The importance of laparoscopy in complicated appendicitis is still matter of controversy. It is not clearly defined that there is a superiority of laparoscopic appendectomy on open technique *(Horvath et al., 2017).*

In 2006, Sajid defined needlescopic instrument as any instrument has a diameter 3mm or less which can be used

in laparoscopic surgery. Needlescopic appendectomy (NA) is an evolving technique. In experienced hands, it extends the benefits already proven for LA versus open appendectomy *(Donmez et al., 2016)*.

*Sajid et al. (2006)* reported that needlescopic appendectomy is feasible, safe and reproducible technique in selected patients for the treatment of acute appendicitis. Moreover, they emphasized on less tissue trauma associated with this minimally invasive approach and cosmetically superior to conventional laparoscopic appendectomy after conduction of the first successful needlescopic appendectomy *(Donmez.et al., 2016)*.

Our technique in management of acute appendicitis was through ultra needlescopic appendectomy through one port incision by instruments having diameter ≤ 2 mm. Laparoscopic appendectomy becomes widely an alternative way in management of such cases for its advantages as it provides better visualization, cosmosis and minimal tissue trauma. Needlescopic appendectomy in appendicitis may be feasible, efficient and associated with less intra-operative and postoperative complications.

**The purpose of this study was to** evaluate the feasibility, safety, efficacy and merits of using "Needlescopic" approach.

## PATIENTS AND METHODS

This prospective study was accomplished for 40 patients with uncomplicated appendicitis, and attended to the Pediatric Surgery Department of Al-Azhar University Hospitals, in Cairo, Egypt, and Mataria Teaching Hospital during the period from May 2019 to February 2020.

The study was presented for approval from the ethical committee of the Faculty of Medicine, Al-Azhar University. Informed written consents were taken before recruitment in the study after explaining the details of the procedure and possible complications of the operation to the parents or caregivers (20 males and 20 females).

**Inclusion criteria:**

Ages ranging from 6 to 16 years (mean age 10 years), diagnosed as uncomplicated appendicitis based on history, clinical examination, laboratory findings and ultrasonography.

**Exclusion criteria:**

Patients with complicated appendicitis (appendicular abscess and appendicular mass), patients with hidden appendix, patients with history of previous major abdominal operations, general conditions contraindicated with laparoscopy such as cardiac problems, pulmonary problems or coagulopathy, patients not fit for surgery, and patients with signs of diffuse peritonitis.

All patients were subjected to full history taking, full clinical examination, and laboratory investigations. Modified Scores: Pediatric Appendicitis Score (PAS) was utilized for diagnosis of acute appendicitis.

**All patients were subjected to radiological investigations:** Plain abdominal X-ray and Pelvi-abdominal

ultrasound. Computed tomography (spiral CT) was requested in some patients.

**Pre-operative preparations:** The patient was fasting 6 hours before the operation with fluid and electrolyte homeostasis, and antibiotics were intravenously administrated. [3rd generation cephalosporin's 100mg/kg/day and Metronidazole 7.5mg/kg/dose].

**Preoperative evaluation:** Eligibility of patients to undergo laparoscopy was carried out based on respiratory and cardiovascular system function.

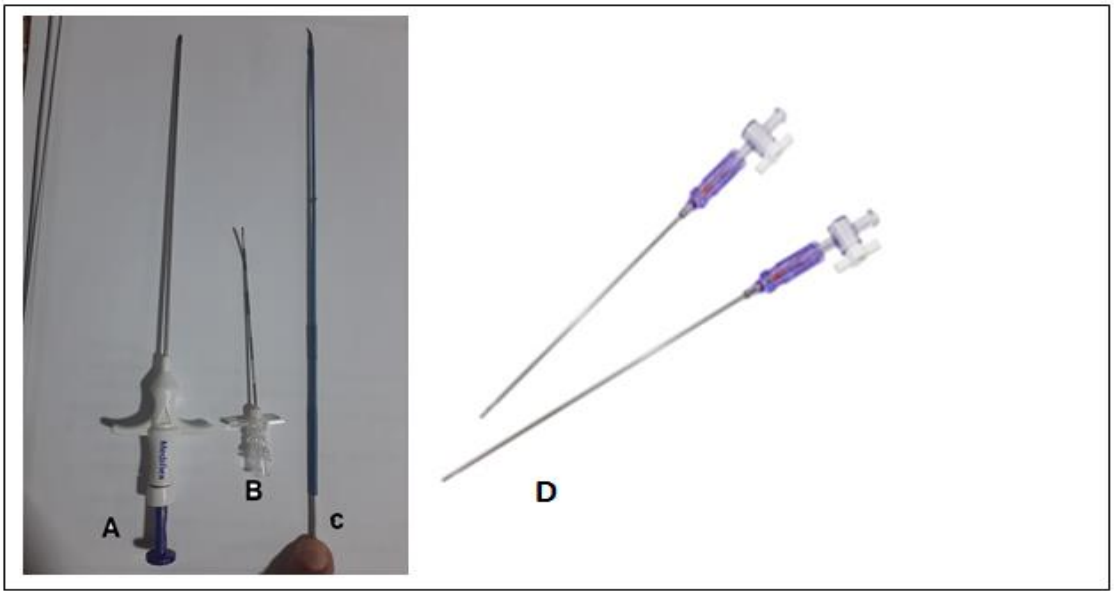
All patients were given instructions to empty the bladder before coming the operative theater, and nasogastric tube was inserted to decompress the stomach after induction of endotracheal general anaesthesia.

**Surgical Technique:**

**1. Instruments:**

- Ten-millimeter trocar and a 10-mm 30° telescope.
- Two 14-G suture grasper devices (SGDs; Mediflex Company, Islandia, NY) **(Fig.1A)**.
- 18-G epidural needle (EN) **(Fig.1B)**.
- A thin homemade insulated long diathermy probe (LDP) **(Fig.1C)**.
- Veress needle.

The LDP was a tapered out 15-cm long Kirschner wire of 1.4-mm thickness and insulated by a thin autoclavable sheath. It fits directly in the regular diathermy handle (Fig.1C). It differs in diameter along its working length started with 1.4mm in diameter at the point of entrance inside the abdomen and ends by tapered end at its working tip.




**Figure(1): Instruments used for Needlescopic appendectomy: (A) Suture grasper device (SGD), (B) Epidural needles, (C) Long diathermy probe, and (D) veress needle**

**2. Operation room setup and patient position:**

The patient was placed in the supine position with little titling to the left side

and the table to 30o anti-Trendelenburg position. The surgeon stands to the left side of the patient, the camera holder at right side of the surgeon(C), the assistant stands to the right side of the patient (SA). We typically put the monitor at the right side of the patient near right foot of the table and patient was exposed from the nipple to the supra pubic area.

**3. Operative technique:**

The abdomen was accessed by open method through a vertical trans-umbilical skin incision about 1 cm to introduce 10-mm telescope with 30 degree.

Pneumo peritoneum was established, and the abdomen was insufflated with CO2, sustaining intra-abdominal pressure from 8 to 12 mm-Hg according to the age. A 1.5-mm skin puncture by 11-blade scalpel was done at point A (2cm above the McBurney's point). A 1.5-mm 11-blade scalpel puncture is done at point B (midway between the umbilicus and pubic bone **(Fig. 2)**.


**Figure (2): The umbilical port and skin puncture points (A, B)**

The abdomen was explored laparoscopically to confirm the diagnosis. In the presence of concealed appendix, appendicular mass or generalized peritonitis, the procedure was converted to conventional laparoscopy and the case was excluded from the study.

The first SGD was introduced through point A (SGD-A) and another one through point B (SGD-B),then the cecum was identified and manipulated to explore the appendix. If the cecum and appendix were freely mobile, the tip of the appendix was grasped by SGD-A and cauterization of mesoappendix was done by using LDP which introduced through point B then the appendix exteriorized through the umbilical port and appendectomy was completed extra corporeally **(fig. 3)**.

**Figure (3): Extra corporeal appendectomy through the umbilical port incision**

The ligated appendicular stump was repositioned into the abdominal cavity and the abdomen was re-insufflated to check for any bleeding points and for suction/irrigation if needed using a Veress needle, which was inserted through point B.

**Utilization of extracorporeal sliding knots:**

If the appendix inflammed, and cannot be grasped by SGD , or if the cecum fixed, the appendicular tip was caught by one SGD to achieve proper visualization of mesoappendix, and seized up by hanging proline suture 2/0 through abdominal wall 2-3cm below McBurney point to pass through the meso-appendix to come back through the same skin puncture. This hitching suture was important to facilitate exposure and ligation of appendicular base and meso-appendix .We introduced EN G-18 (its tip was intentionally bent into a gentle curve for easy handling and tissue manipulations) through point A and advanced to pass through the mesoappendix in the avascular area as shown in **fig. 4**. We then passed a 2/0 Vicryl® (Ethicon, Inc. Somerville, NJ) suture through it around the appendix near its base and EN was removed to insert SGD through the same skin puncture (point A) and to extract both ends of the thread after encirclement of the base of the appendix. An extracorporeal sliding knot (Meltzer sliding knot or French sliding knot as described by *Shalaby et al, 2020)* was constructed, then traction of long limb of the thread leads to sliding of the knot smoothly through the skin puncture to be tightened around the appendicular base by traction against the anterior abdominal wall after partial deflation of the abdomen. The long limb of the thread was subsequently trimmed outside the abdomen. The same maneuver was repeated for ligation of the meso-appendix. The long diathermy probe (LDP) was used to separate the mesoappendix after being ligated. The appendix was seized up by SGD at point B to be extracted through the umbilical port **(fig. 4)**.

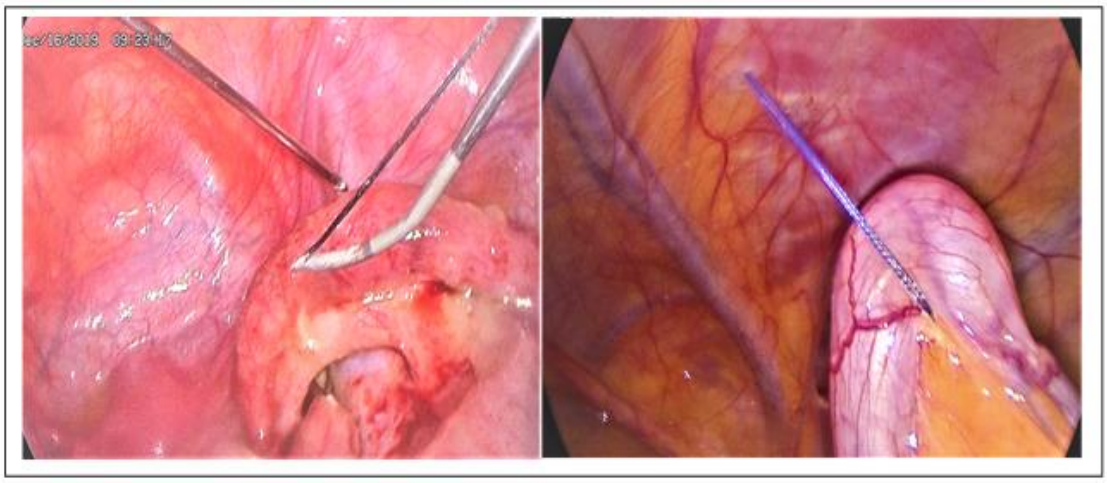


**Figure (4): Introduction of thread through epidural needle, then pass through the mesoappendix in the avascular area to ligate of the base of appendix**

**Complete intracorporeal ligation:**

In cases of severe appendicular inflammation with pelvic or paracolic collection, we used veress needle for adhesolysis to dissect the fibrinous adhesions between the appendix and the surrounding structures. The dull tip of veress needle allow manipulation of inflammed tissues, dragging of inflammed appendix and creation of tissue planes without causing injury by outer sharp cannula moreover, it is used as suction irrigation device similar to suction irrigation cannula of the ordinary laparoscopic instruments.

In such cases of swollen oedematous appendix with fixed cecum we hold the distal part of meso-appendix by SGD at point B. the veress needle is introduced at point A for suction of inflammatory reaction, release of omental adhesions and mobilization of inflamed appendix.

Then, the veress needle at point A was removed and EN G-18 inserted through point A and advanced to pass through the mesoappendix through the avascular point near the base of the appendix, meanwhile SGD at point B was holding the appendix. A 2/0 Vicryl suture was then threaded through the EN to appear on the other side of the mesoappendix. The EN is removed to be replaced with SGD and the long limb of the thread kept outside the abdominal cavity, SGD at point A caught the short limb of the thread around the meso-appendix to turn on right side of the long limb to form first loop and turn on the left side of the long limb to form the second loop to construct intracorporeal knot as described by *Ismail et al. (2019)*.

Alternatively, both SGD at point A and point B were utilized to construct intracorporeal surgical knot mimicking that we are doing with ordinary laparoscopic instruments to be tightened, then both limbs of the thread exteriorized by SGD at point A for trimming outside the abdominal cavity. The same maneuver was repeated for double ligation of the base of the appendix **(Fig.5 a-f)**.

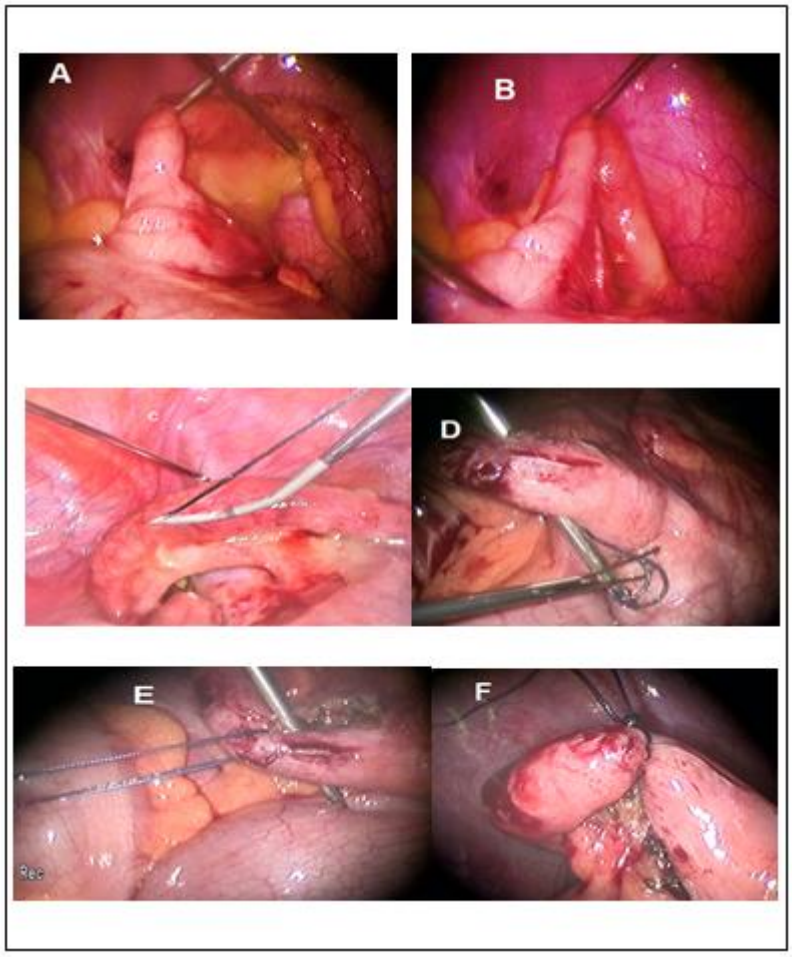



**Figure (5): Steps of manipulation of the appendix, division of adhesions, and intracorporeal ligation of the base of the appendix. (A)** Identification of the appendix. **(B)** Grasping of the mesoappendix with SGD. **(C, D)** Passing a Vicryl® suture around appendix using EN. **(E, F)** Ligation near the base of the appendix using Extracorporeal French Sliding Knot. EN, epidural needle.

After secure ligation of the mesoappendix and the base of the appendix, LDP was directly introduced via point A to separate the mesoappendix from the appendix by cauterization. (Fig.6 and 7 ), and the appendix were transected between two ligatures using LDP through point A.

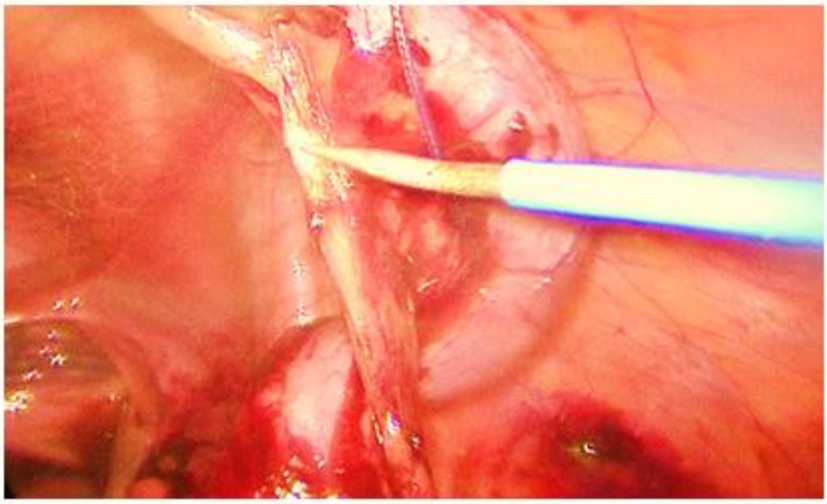


**Figure (6): Separation mesoappendix from appendix by cauterization using LDP**

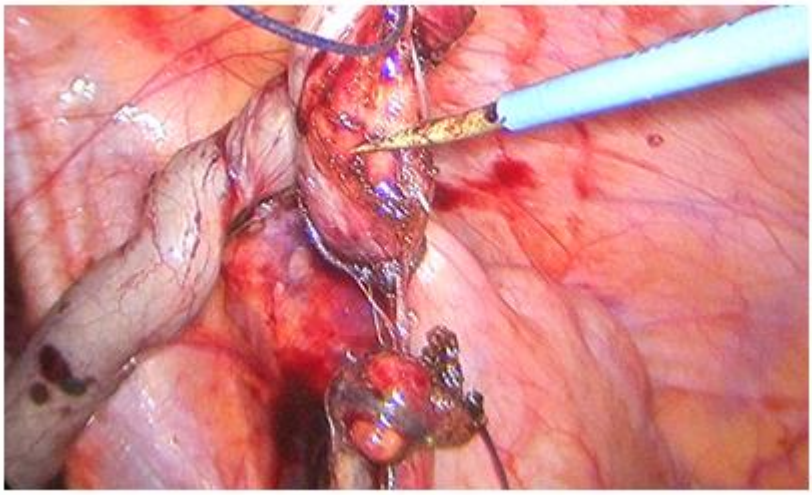


**Figure (7): Transection of ligated appendix by cauterization using LDP between two ligatures**

The base of the appendix or the suture ends around the base were grasped by SGD-A and pushed within the umbilical trocar where the appendix was completely delivered inside the port **(Fig. 8)**.

**Figure (8): Extraction of the appendix through umbilical port.**

Procedure was then completed as previously mentioned. Deflation of the abdomen was done and the umbilical fascial incision was closed using 2/0, and the umbilical skin was closed using 4/0 Vicryl.

**Postoperative management:** Patients kept NPO and received intravenous fluids, antibiotics, and analgesics according to hospital protocols. Patients started oral fluids after regain of intestinal movement and the diet was advanced gradually as tolerated. Patients were discharged the second postoperative day.

The main outcome measurements were the mean operative time in minutes which was calculated from the start of skin incision to the time of skin closure, intra-operative complications, post-operative pain time for first post-operative need of analgesia, Post-operative hospital stay in hours, and post-operative early and late complications.

**Follow-up:** After discharge, all children were followed after 1 week, 2 weeks, 1 month, and 3 months for assessment of the cosmetic outcome, presence of pelvic collection, and port-site wound sepsis and hernia.

**Statistical analysis:**

Results of the present study were statistically analyzed using SPSS 25 (IBM, USA). Data were represented as mean± standard deviation, or number and percentage.

## RESULTS

This prospective non-randomized controlled clinical trial study of needlescopic appendectomy was conducted on forty children. They were 20 males and 20 females with mean age of the studied group were 10 years ranged from six to fourteen years with a mean weight 30 kg. By preoperative investigations, the mean hemoglobin level of studied patients was 13.1±1.70, and mean total leucocytic count was 14.49±2.50, and 47.5% had normal urine analysis and 52.5% had few urates in urine **(Table 1)**.

**Table (1): Demographic data of the studied group (N=40)**

| Studied variables | Studied group |
|---|---|
| **Age / years** | |
| Mean ±SD | 10.2±2.50 |
| Range | 6 - 14 |
| **Gender** | |
| Male | N (%) 20(50.0) |
| Female | 20(50.0) |
| **weight / Kg** | |
| Mean ±SD | 30.0±5.27 |
| Range | 17 - 38 |
| **Hemoglobin level (g/dl)** | |
| Mean ±SD | 13.1±1.70 |
| Range | 10 - 17 |
| **Total leucocytic count (TLC)$10^3$** | |
| Mean ±SD | 14.49±2.50 |
| Range | 9.80 - 19.3 |
| **Urine analysis** | **N (%)** |
| Nil | 19(47.5) |
| Few urates | 21(52.5) |

On preoperative examination, all patients had abdominal pain, 97.5% had abdominal tenderness, 85% had anorexia, 70% had nausea and vomiting and abdominal rigidity, 45% of them had fever, and only one case (2.5%) had abdominal distension. By using abdominal ultrasonography, half of the patients (2.5%) had mild free fluid collection in ultrasound examination, 7.5% had mesenteric lymphadenitis, 2.5% were normal, and (87.5%) had inflamed appendix **(Table 2)**.

**Table (2): Preoperative examination among studied group (N=40)**

| Studied variables | No. | % |
|---|---|---|
| **Abdominal pain** | | |
| Yes | 40 | 100 |
| No | 0 | 0.00 |
| **Anorexia** | | |
| Yes | 34 | 85.0 |
| No | 6 | 15.0 |
| **Nausea and vomiting** | | |
| Yes | 28 | 70.0 |
| No | 12 | 30.0 |
| **Fever** | | |
| Yes | 18 | 45.0 |
| No | 22 | 55.0 |
| **Abdominal distension** | | |
| Yes | 1 | 2.50 |
| No | 39 | 97.5 |
| **Tenderness** | | |
| Yes | 39 | 97.5 |
| No | 1 | 2.50 |
| **Guarding (rigidity)** | | |
| • Yes | 28 | 70.0 |
| • No | 12 | 30.0 |
| **Ultrasound** | | |
| Normal | 1 | 2.50 |
| Mild free fluid collection | 1 | 2.50 |
| Mesenteric lymphadenitis | 3 | 7.50 |
| Inflamed appendix | 35 | 87.50 |

The mean operative time of studied group was 47.5±17.7 minutes, 55% of patients had omental adhesions intra-operatively, and 67.5% had free fluid collections. Regarding pathological appearance of appendix 42.5% were catarrhal, 32.5% were non suppurative, 22.5% were suppurative, and only one appendix (2.5%) was gangrenous. The mean hospital stay after operation was 23.9±5.02 hours, and mean time to start oral feeding was 16.5 ± 4.04 hours. No cases needed drain insertion postoperatively (Table 3).

**Table (3): Intra-operative data among the studied group (N=40)**

| Studied variables | Studied group |
|---|---|
| **Operative time / minutes** | |
| Mean ±SD | 47.5±17.7 |
| Range | 30 - 135 |
| **Omental adhesions** | **N (%)** |
| Yes | 22(55.0) |
| No | 18(45.0) |
| **Free fluid collections** | **N (%)** |
| Yes | 27(67.5) |
| No | 13(32.5) |
| **Pathological appearance** | **N (%)** |
| Acute catarrhal | 17(42.5) |
| Suppurative | 9 (22.5) |
| Non suppurative | 13(32.5) |
| Gangrenous | 1(2.50) |
| **Hospital stay / hours** | |
| Mean ±SD | 23.9±5.02 |
| Range | 18 - 36 |
| **Drain insertion** | **N (%)** |
| Yes | 0(0.00) |
| No | 40(100) |
| **Start of oral feeding / hours** | |
| Mean ±SD | 16.5±4.04 |
| Range | 10 - 25 |

In post-operative follow up we found no wound complications occurred such as port site infection or port site hernia.27 patients from the studied group discharged during first 24 hours **(Table 4)**.

**Table (4): Post-operative complications and discharge among the studied group (N=40)**

| Studied variables | No. | % |
|---|---|---|
| **Complications** | | |
| Port site hernia | 0 | 0(0.00) |
| Port site infection | 0 | 0(0.00) |
| Discharge during first 24 hours | 27 | 67.50 |

## DISCUSSION

LAP has many advantages over open appendectomy, including better visualization of the entire abdomen, reduced postoperative adhesions, decreasing rate of surgical-site infection, shortened hospital stay, reduced postoperative pain, and significant improvement of cosmetic outcome *(Alsoueni et al., 2020)*.

However, the scars of conventional laparoscopic surgery seem to be more visible is facing several challenges due to the cost of the port, improper instrument ergonomics, and a relatively big umbilical wound. So, it is not popular and far from

being the gold standard *(Shalaby et al., 2020)*.

We tried to reduce costs and make invisible scars by using only needles which were rigid enough, durable unlike the 2-mm laparoscopic instruments, and did not bend during its manipulation through the abdominal wall. These needles were originally used in facial closure of port sites during laparoscopic surgery. The Suture Grasper Device has no jaw, so it did not entrap the thread during knot formation, and its small diameter allowed it to pass easily through the formed loop of the knot. Also, it can be used with good ergonomics in dissecting a severely inflamed appendix without squeezing or rupturing the appendix. Moreover, it allowed for both intra and extracorporeal ligation in LAP in children.

In our study, we observed that Needlescopic Appendectomy using a SGD were less invasive and resulted in improved cosmoses. The needle punctures were almost invisible, low cost, with no need for conversion to either multiport or traditional open technique. No port-site infection or herniation was found in any single case. In experienced hands, NA in children was feasible, and can be performed safely in patients with non-complicated acute appendicitis. Also, in our series, we observed that, at certain skill level additionally, patients who underwent NA had shorter recovery times. Finally, we demonstrate a little difference between NA and multiport LA in analgesic requirements.

In our study, SGD was used as a Maryland manipulating the appendix, holding the mesoappendix, and handling sutures. Besides the 10 mm umbilical ports for the telescope, we used EN, SGD, and homemade LDP. Both SGDs and EN were used for passing, ligation, and tightening of the suture around the mesoappendix and appendicular base. Pulling and cutting of the threads outside the abdomen saved the time of operation.

*Perea et al. (2018)* concluded that trans umbilical extracorporeal LAP for non-perforated appendicitis is safe, effective, and feasible in more than 60% of cases and it can be easily converted to conventional LAP.

*Boo et al. (2016)* mentioned that exteriorization of the appendix through the umbilicus is simple in children than adults due to shorter distance. So, transumbilical extracorporeal LAP was possible in most pediatric cases. In few instances, they had to do some lateral cecal mobilization and even ligation division of the mesoappendix for easy and safe exteriorization of the appendix.

Compared with 2-mm NAP and SILAP, our NAP using smaller size and rigid needles were less invasive, lower cost, and with better cosmetic results. We managed to successfully treat all cases with our new technique using only needles with almost invisible scars. As expected, the mean operative time of extracorporeal NAP was significantly shorter than that of intracorporeal one due to handling of appendix and performing knots. Oral feeding started 6 hours postoperatively, and early mobilization was stressed on, this allowed all cases to be discharged on the second postoperative day.

Wound infection after LAP is common due to soiling from appendix and can be avoided by extracting the appendix in a

sterile glove or passing it through the trocar *(Perea et al., 2018)*.

In this study, there were only one umbilical wound without possibility for postoperative wound infection, port-site hernia, or intra-abdominal collection, mostly because we decreased numbers and sizes of wounds used for introduce the instruments and had only punctures for needles which were not liable for incidence of herniation or infections. Also, extraction of the appendix through the umbilical port prevented soiling of the wound.

We tried to evaluate scars by searching for objective tool but regrettably we did not find appropriate tool. Patient and Observer Scar Assessment Scale (POSAS), modified POSAS, Matching Assessment of Scars and Photographs, and modified Vancouver Scar Scale and other several scales have attempted to incorporate subjective data (pain and pruritus) into scar assessment, but this was not applicable in our study *(Perea et al., 2018)*.

*Nguyen et al. (2015)* concluded that multiple scar assessment scales have been developed to help assist in the consistent evaluation of scar severity, progression, and response to treatment.

However, no gold standard scar scale existed to date. Looking at our scars, they were nearly invisible as there were two tiny skin punctures <1.5mm (needle punctures), and the 10-mm scar of the telescope was already hidden in the umbilical cicatrix. Eventually, the procedure almost ended with a scarless abdomen after a 3-month follow-up. The present technique for NAP optimizes the minimal invasiveness of LAP. NAP uses only needles in children and adolescents, is safe, cheap, reproducible, and with scarless abdomen *(Shalaby et al., 2020)*.

According to *Ismail et al. (2019)* NA in children using a MedN (SGD) extend the benefits already proven for LA versus open appendectomy. It further hastens recovery and reduces postoperative pain and length of hospital stay. NA is a feasible procedure and can be performed safely in children, especially in young girls (where excellent cosmetic results are desired) for the treatment of acute appendicitis. It is less invasive and cosmetically superior to LA. Additionally, NA reduces the element of surgical trauma, due to a small skin wound and fine tissue handling. It allows us to operate with a smaller skin wound and more gentle tissue handling without compromising access, so a better outcome is anticipated. There is a balance that pediatric surgeons must strike between trauma secondary to surgery and adequate access.

## CONCLUSION

Needlescopic appendectomy was more difficult than conventional laparoscopic appendectomy. The major difficulty with NA stems from the need for the surgeon to adapt to the new method of instrumentation. The used needles can be helpful not only in appendectomy, but also in different kinds of minimally invasive laparoscopic operations. As a result, laparoscopic appendectomy with the help of a needle grasper can give good results. By using this technique, the number of ports used can be decreased and better cosmetic results may be achieved.

**Conflicts of interest:** no conflicts of interest were encountered.

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# إستئصال الزائدة الدودية في الأطفال بتقنية الابر الدقيقة للمنظار الجراحي

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**خلفيـــة البحـــث:** التهـــاب الزائـــدة الدوديـــة الحـــاد مـــن حـــالات الطـــوارئ الجراحية الأكثر شيوعا لدى الأطفال.

**الهـدف مـن البحـث:** شـملت هـذه الدراسـة 40 مريضـاً تـم إدخـالهم إلـي قسـم جراحـــة الأطفـــال فـــي مستشـــفيات جامعـــة الازهـــر ومستشـــفي المطريـــة التعليمـــي خـــلال الفتـــرة مـــن مـــايو 2019 وحتـــي فبرايـــر2020، وهـــم يعـــانون مـــن إلتهـــاب حـــاد بالزائـــدة الدوديـــة، وتـــم تقيـــيم المرضـــى حســـب المعـــايير الآتيـــه: وقـــت العمليـــة الاساســـي بالـــدقائق وتـــم حســـابه بدايـــة مـــن فـــتح الجلـــد وانتهـــاءا بـــاغلاق الجـــرح، والمضـــاعفات أثنـــاء العمليـــة، والألـــم مـــا بعـــد العمليـــة، وأول وقـــت بدايـــة الحاجـــة للمســـكنات بعـــد العمليـــة، والمضـــاعفات المبكرة والمتأخرة ما بعد العملية.

**نتـــائج البحـــث:** خـــلال مـــدة البحـــث كـــان عـــدد الـــذكور 20 مريضـــاً وعـــدد الانـــاث 20 مريضـــة. وتـــم اســـتكمال العمليـــات كلهـــا بنجـــاح دون الحاجـــة إلـــي تحويلهـــا إلـــي إستئصـــال الزائـــدة المفتـــوح اوالمنظـــار الثلاثـــي العـــادي. مـــؤخرا ومـــع زيـــادة معـــدل الحـــالات والتـــدريب المســـتمر أصـــبحت التقنيـــة اكثـــر ســـهولة والوصـــول إلـــي الزائـــدة صـــار اكثـــر ســـهوله ، والحـــالات التـــي يصـــعب فيهـــا الوصـــول للزائـــده مـــع وجـــود التصـــاقات كثيـــره يـــتم تحويلهـــا الـــي طريقـــة المنظـــار الثلاثـــي المـــدخل أوالـــي استئصـــال الزائـــدة المفتـــوح ويـــتم إســـتبعادها مـــن الدراســـة مـــن البدايـــة. وقـــد إحتـــاج 7 مـــن مرضـــى البحـــث الحقـــن بمســـكنات

الألم غير الاسترويدية في فترة أقل من أو يساوي 3 ساعات.وتم إخراج 27 من مرضي البحث من المستشفي خلال أول 24 ساعة بنسبة 67.5% من المجموعه. ولم يحدث الإلتهاب الخلوي للسرة ما بعد العملية أو فتق سري، حيث تم مراعاة الجرح مع إضافة مضادات حيوية للعلاج المنزلي.

**الاستنتاج:** إستئصال الزائدة الدودية عن طريق المنظار ذو المدخل الواحد عن طريق الابر الدقيقة هي طريقة أكثر صعوبة من إستئصال الزائدة الدودية عن طريق المنظار المعتاد . وتكمن الصعوبة في إحتياج الجراح للتعامل مع الآلات الجديدة. ويمكن أن يساعد استخدام الابر ليس فقط في إستئصال الزائدة الدودية ولكن في مختلف عمليات المناظير ذات التدخل المحدود ونتيجة لذلك فإن إستئصال الزائدة الدودية بالمنظار باستخدام الإبر لها نتائج جيدة وباستخدام هذه التقنية فإن عدد المداخل يمكن تقليلها مما يعطي نتائج جمالية.