

Faculty of medicine
Ain –shams university
Post graduate

DIFFERENT TECHNIQUES OF USING KNOTTING IN LAPAROSCOPY

Essay For partial fulfillment
Of
MSc degree in general surgery

Submitted By
Islam Mahmoud Safwat Abdel-Hamid

SUPERVISORS

PROF

Sameh Abdel-Hai Abdel-hamid
Professor and head of unit
of pediatric surgery
Faculty of medicine-Ain shams
university

Dr.

Hatem Abdel-Kader Saafan
Assistant prof of pediatric surgery
Faculty of medicine-Ain shams
university

Dr.

Hesham Mohammed Abdel-Kader
Lecturer of pediatric surgery
Faculty of medicine-Ain shams
university

2009

Aim of the work

To review different types ,methods of knotting plus materials and instruments used, the most recent techniques for laparoscopic knot tying and assessment of the knot according to time to perform, reliability, simplicity,tissue approximation security,slippage and breaking point.also to review recent modalities in laparoscopic suturing like clips and staplers.

This eassy will describe also a reliable and efficient technique for laparoscopic needle positioning and appropriate choice of the suture and needle used to perform a secure knot.

Introduction

Since the late 1980s, the laparoscopic approach to many procedures has frequently been used. Laparoscopic procedures have gained momentum due to decreased morbidity, shorter hospital stays, and a quicker recovery compared with a more “traditional” open approach. The pressures of reduced resident work hours, increasing costs of operating room time have contributed to the demand for establishing curricula to teach fundamental technical skills in the laboratory .

Despite recent advances in both suture welding and knotless anchor technology, knot tying will remain a necessary skill which the surgeon must master. There are an endless number of combinations of knots (sliding versus static, simple versus complex, etc.) and suture types (monofilament and braided) to accomplish this task.

A knot should be simple, easy, quick, and reliable and secure tissue approximation.

Laparoscopic technical skills such as intracorporeal suturing and knot tying are fundamental to becoming “proficient” in minimally invasive surgery (MIS). There is an increasing focus in residency training programs and in private practice general surgery on the ability to perform

this skill in a safe and efficient manner. Although there has not been uniform agreement about optimal training methods, research has demonstrated that the use of simulation clearly improves MIS technical skills.

Also, recent data suggested that using a proficiency-based training strategy may represent a better method for the learner .

This easy`ll describe also the most recent techniques for laparoscopic knot tying.

Extracorporeal without extra mechanical devices was developed and named Gea knot which is a good alternative for laparoscopic procedures in comparison with Roeder knot and the classic surgical knot.

We can use different types of sutures like polypropylene, silk, catgut, polyglycolic acid and polyglactin 910

Assessment of the knot is according to time to perform, slippage, and breaking point

Until now no attempt have been made to modify suture material in order to facilitate this process so we`ll also present an evaluation of a novel modified suture material designed to allow inexperienced surgical residents to tie intracorporeal knot laparoscopy using conventional laparoscopic needle drivers.

List of abbreviations

AJLS.....American joint of laparoscopic surgery.
PDS.....poly dioxanone sulfate.
OTIG.....operative technique of general surgery.
RHAP....Reversed half hitches on alternating posts.
RHSP....Reversed half hitches on same posts.
HTL.....Hand tied ligature.
PTL.....Pre tied ligature.
PLKProximal locking knot.
DLK.....Distal locking knot.
SMC.....Sliding middle locking.
MRK.....Modified roeder knot.

List of contents

Topic	page
Acknowledgment	I
List of figures	II
List of abbreviations	IV
Aim of the work	1
Introduction	2
Evolution of tying in laparoscopy	4
Suturing technology from the past	10
Choice of suture material and needle	12
Role of extracorporeal knots in laparoscopy	27
Intracorporeal knot-tying and suturing technique in laparoscopy	58
Laparoscopic clips	79
Laparoscopic stapler	82
Recent modalities in laparoscopic surgery	87
Conclusion and recommendations	89
References	94
الملخص العربي	102

List of figures

Fig 1	The length of the suture tract is considerably longer than it's width
Fig 2	Endoski Needle
Fig 3	The needle provides a grip for the needle driver
Fig 4	The needle penetrate the tissue to create a tunnel for the suture
Fig 5	The selection of the needle length is determined by the distance between the entrance and exit bites when the tissue edges are aligned and the length of needle that need to emerge from the exit point
Fig 6	Common circle needle configuration
Fig 7	1\2 circle needle
Fig 8	Compound needles a j-shaped b-fishhook c-compound curved
Fig 9	Cutting tips
Fig 10	Spatulated tips
Fig 11	An eyed needle
Fig 12	Needle holder
Fig 13	Techniques of capsizing, flipping, and flyping
Fig 14	Half hitches
Fig 15	Reversed half hitches on same post
Fig16	Reversing half-hitch and alternating posts
Fig 17	Numerous sliding knots
Fig 18	Different types of sliding knots
Fig 19	Non-sliding (static) knots
Fig 20	Step 1 Roeder's knot
Fig 21	Step 2 Roeder's knot
Fig 22	Step 3 Roeder's knot
Fig 23	Step 4 Roeder's knot
Fig 24	Step 1 Meltzer slip knot
Fig 25	Step 2 Meltzer slip knot
Fig 26	Step 3 and step 4 Meltzer slip knot
Fig 27	Step 1 Tayside knot
Fig 28	Step 2 Tayside knot
Fig 29	Step 3 and step 4 Tayside knot
Fig 30	Weston knot
Fig 31	Pre-tied loop

Fig 32	Knot pushers
Fig 33	Evaluation of a loop and knot security
Fig 34	Correct needle grasping and movement
Fig 35	Intracorporeal knotting technique
Fig 36	Intracorporeal knotting technique
Fig 37	Intracorporeal instrument tie
Fig 38	Jones insert knot
Fig 39	Knot tying with endo stitch device
Fig 40	Technique of intracorporeal knotting
Fig 41	Extra corporeal performed loops of continuous suturing
Fig 42	Simple way to introduce in the abdominal cavity the performed loops for continuous suturing
Fig 43	Extracorporeal continuous loops for continuous suturing
Fig 44	Extra corporeal performed loops for continuous suturing
Fig 45	Continuous suturing with the aid of PDS clips
Fig 46	Clip applier
Fig 47	Stapler

Evolution of tying in laparoscopy

Throughout the history, surgeons have utilized endoscopes to gain access to cavities of the human body. The industrial revolution provided the means to improve these instruments.

Instruments closely resembling laparoscopic trocars have been recovered from Roman ruins). Similarly, Albukasim described an "exploring needle with a groove" mounted on a handle. The term "trochar," however, was not coined until 1706, and is thought to be derived from *trochartor troise-quarts*, a three-faced instrument consisting of a perforator enclosed in a metal cannula... (Elkousy et al., 2005)

The first endoscopic examinations of the peritoneal cavity were accomplished early in the 20th Century. In 1901, Dimitri Ott, a German gynecologist described "ventroscopy," a technique in which a speculum was introduced through an incision in the posterior vaginal fornix. Ott wore head mirrors to reflect light and augment visualization

In 1929, Kalk introduced the foroblique (135 degrees) lens system, and advocated the use of a separate pneumoperitoneum needle and a second puncture site.

These refinements in technique, along with Kalk's descriptions of therapeutic laparoscopic interventions earned him the designation as the "Father of Modern Laparoscopy...(Tait PG., 1898)

Belonging to the beginning of knot tying, In 1966, Kurt Semm was the first man who introduced an intra-and extra-corporeal knot-tying techniques and perfect EndoLoop applicator This allowed for safer laparoscopy, and bowel perforations and retroperitoneal vascular injuries subsequently declined...(Luks FI et al., 1994)

These technical advances elevated laparoscopy to a safe procedure which could be utilized in common clinical settings.

Therapeutic uses of laparoscopy were rapidly developed. Along with the technical advances, Semm adapted numerous surgical procedures to laparoscopic techniques, including tubal sterilization, salpingostomy, oophorectomy, salpingolysis, and tumor reduction therapy. Beyond the realm of gynecologic surgery, Semm popularized laparoscopic procedures such as omental adhesiolysis, bowel suturing, tumor biopsy and staging, and notably, incidental appendectomy... (Snyder SJ et al.,1997)

Rewarding to extracorporeal knots The first laparoscopic appendectomy was performed by DeKok in 1977. This was a laparoscopically-assisted procedure, with a mini-laparotomy performed to remove the non-inflamed appendix....(Croce E, et al.,2000)

Semm performed the first complete laparoscopic appendectomy in 1983. His technique, recommended only for non-acute cases, consisted of an extracorporeal ligation of the mesoappendix with endoscopic ligation of the appendix with a pretied loop. The appendix was transected across its base with electrocautery....(Shimi SM et al ., 1994).

The first laparoscopic sliding knot to be described was the Roeder knot; it has been used for a variety of procedures in all surgical disciplines. It was surmised that the introduction of new modifications in the geometry of the knot paralleled the introduction of its new indications, and that not all modifications improved its security. Therefore, a geometrical review was made of all modifications and all data on knot security and loop security of the knot were analyzed.

The introduction of the original knot and its 14 applicable modifications paralleled the increase in

minimally invasive techniques and the spread of these techniques in all the medical specialties ...

Roeder loop security depends predominantly on the number of initial turns around the standing part. Its knot security depends on the additional half hitches used to backup the knot after it has been tightened. Only a few of the modifications improved the security of the knot or its previous modifications.

Laparoscopy subsequently became a practical and popular technique for the evaluation and treatment of right lower quadrant pain in females, utilized by general and gynecologic surgeons alike..... **(Pattas M et al 2006)**

Although interest was piqued, general surgeons still considered laparoscopy a "blind" procedure, fraught with risks of intra abdominal injuries, and thus did not incorporate the technique into the practice of general surgery.

By the late 1970's, gynecologic surgeons had embraced laparoscopy and thoroughly incorporated the technique into their practice. General surgeons, despite their exposure to laparoscopy in consultation with gynecologic colleagues, remained skeptical and staunchly supported traditional open surgery.

In 1978, Hasson introduced an alternative method of trochar placement which permitted direct visualization of trochar entrance into the peritoneal cavity. Subsequent to the development of the Hasson technique, general surgeons became more receptive to laparoscopic surgery, as the open technique allayed fears of bowel and vascular injuries...(Snyder SJ et al.,1997)

Since 1970 the suture needle forceps has been improved. Originally it was marketed as a forceps on an extendible jaw of which was a needle with a groove at the distal end. Later, a needle with eye at the distal end was fixed to an extendible jaw. Today, on one of the double acting jaws, there is a detachable needle with an eye at its distal end. Various types of needles and suture are changeable on the instrument.

Rewarding to intracorporeal knots on July 26, 1991, Joseph Uddo performed an entirely laparoscopic right hemicolectomy: the ileocolic anastomosis was constructed intracorporally. In a rapid succession, virtually all types of colorectal procedures were accomplished using minimally invasive techniques.

Through minimally invasive techniques, surgeons could safely and effectively treat a larger patient population. Patients suffer less postoperative pain,

develop fewer infections, resume oral intake and are discharged sooner than after laparoscopy performed through a standard surgical incision .

Suturing technology has emerged from the past as one of man`s earliest crafts

Archeological findings have produced evidence of surgery specifically the use of bone needles and horse hair sutures applied to human wounds that date back 2200 to 3700 BC

Additional findings suggest that early sutures and ligatures were derived from plant fibers and animal tissues.

sutures have an important rule in laparoscopic surgery exactly like it`s rule in open traditional surgery.

Sutures are used either to;

1- occlude a structure like a blood vessel, duct...etc, To accomplish this function , laparoscopic clips or stapler can be used.

Staplers and end mechanical devices have represented a revolution in surgical technology and operative technique. Their acceptance, use, and technical development have been a study in evolution, however, During their early introduction using such instruments were thought to be inferior to hand sewn of anastomosis and tissue reconstruction. After many years and many