Summary & Conclusion

Before birth, the layers of the processus vaginalis normally fuse, closing off the entrance into the inguinal canal from the abdominal cavity. In some individuals, the processus vaginalis remains patent. Failure of luminal obliteration; so, a ready-made sac is present (a preformed sac) can result in:

- An inguinal hernia or,
- Hydrocele (communicating or non- communicating).

The incidence of inguinal hernia in children is around 1-5% and increase up to 7-30% in premature infants. The inguinal hernia is liable to many complications especially incarceration which carries the incidence of 7-17% jumping to 60% in premature babies with inguinal hernias. So; there's no place for conservative management with overt inguinal hernia (***Dariusz, et al; 2006)***.

Males are much more likely to have hernias, with the male-female ratio between 3:1 and 10:1. Approximately 60% of hernias are right sided." This is true for males and females. Bilateral hernias are present in approximately 10% of cases. It has been suggested that patients with left-sided hernias are more likely to develop right sided hernias than vice versa. More recent data suggest that this may not be true.

Inguinal hernias are generally found by parents or by pediatricians. There is typically a history of an intermittent bulge in the groin, labia, or scrotum. Hernias may be discovered at birth, or they may present weeks, months, or even years later, but the defect has been there since birth. Because hernia often appears during episodes of infant distress parents, often

think that the hernia is the cause of the distress. Unfortunately, many of these perceived symptoms persist after the repair.

Most surgeons currently recommend repair hernia soon after diagnosis. This practice can result in a significant reduction of complications from the hernia and is practicable because of the safety of modern anesthesia.

Repair of most pediatric hernias requires ligation of the true neck of the sac through the internal ring. The sac should be examined to rule out the presence of a sliding component. In such cases, the sac should be freed, its excess removed, and the entire remaining sac reduced into the abdomen. Since there are no cord structures in female patients, the internal ring can be closed. Occasionally, in male patients with a much dilated internal ring, suturing the transversalis fascia at the ring will narrow the ring.

Besides using the laparoscopic technique for identifying a contralateral patent processus vaginalis using a trans-inguinal approach or to repair a recurrent inguinal hernia, the minimally invasive approach can also be used for repair of inguinal hernias in children. The technique consists in closing the neck of the hernia sac with a purse string suture.

Advantages of the lap procedure include the ability to diagnose and repair concomitantly a contralateral hernia defect, the ability to diagnose a direct inguinal hernia, better cosmetic result, and less surgical dissection. This last issue is called “access trauma” or repair of all the damage caused in gaining the initial access to ligate a hernial sac.

Another benefit is that there is no dissection of the cord structures so that the risk of superior displacement of the testis, testicular atrophy, injury to vas deferens and stitch granuloma is less likely.

Disadvantages include a longer procedure, higher recurrent rates, development of residual hydrocele in males along with the complications attendant in violating the abdominal cavity (vascular and bowel injury caused by Veress needle and trocar insertion). Most surgeons still prefer to do an open subcutaneous procedure with high ligation of hernia sacs as standard repair of inguinal hernia in infants and children**.**

Options for surgical correction:

1. Conventional open repair.
2. Minimal invasive surgery:
    a. Laparoscopic repair.
    b. Laparoscopic needle assisted techniques.
    c. Laparoscopic assisted tissue adhesives.

Conventional Open Repair:

The fundamental principle guiding pediatric hernia repair in elective situation is high ligation of the sac. Both a simple high ligation of the sac via the internal ring without opening the external oblique muscle or the external oblique is opened, and reconstruction of the inguinal canal is performed without altering the relationship of the spermatic cord to the inguinal canal**.**

The surgical repair of hernias in females is simpler than in males because there is no need to identify and preserve a spermatic cord. The hernia identified and inspected for contents. If the sac is empty, it is divided between clamps. The distal sac is dropped back into the wound. The proximal sac is dissected out to the level of the internal ring, twisted, and double- ligated. Then close the ring with one or two sutures and close the

wound in standard fashion. It is not a routine to attach the sac and the round ligament to the conjoint tendon in order to reestablish the normal support for the uterus.

In modern practice, routine exploration of the contralateral side results in many unnecessary procedures, needlessly places the contralateral vas and testicle at risk, and is an unwarranted expense, as only about 20% of patients presenting with a unilateral hernia develop a clinical hernia on other side. Some suggest that the incidence of hernia on the asymptomatic side is as low as 7%. Thus, many surgeons perform selective contralateral exploration based on the sex and age of the patient or the side of the hernia.

Minimal invasive surgery:

MAS results in reduction of postoperative adhesions. Patients stay in the hospital for a shorter period and recover faster. Patients are able to return to their normal activities faster (e.g., feeding, school, work).

A child's quick recovery allows parents to return to work faster. Video imaging allows surgical assistants, anesthesiologists, and nurses to view what the surgeon is doing and to actively participate in the procedure in their respective roles. Laparoscopy can be performed in infants weighing less than 1.5 kg without significant mortality or morbidity.

Laparoscopy often offers better visualization than open surgery, particularly better visualization of the hiatus and deep structures in the pelvis. Minimal access surgery (MAS) offers dramatic advantages in terms of the quality of life after the operation. Postoperative pain is reduced, which decreases postoperative narcotic use and its complications. This also aids in

lower pulmonary complications. Smaller wounds are associated with fewer wound complications, less scarring, and better cosmesis.

Laparoscopic repair has been reported via trans-abdominal approach. Both internal rings are inspected, and direct and indirect hernias are visualized easily. These hernias are repaired, and, if a contralateral hernia is visualized, it is also repaired. The repair consists of ligating the sac from the inside at the level of the internal ring. Injury to the gonadal vessels and vas deferens should be avoided during the closure of the hernia defect.

Laparoscopic inguinal hernia repair can be a routine procedure with results comparable to those of open procedures. It is well suited for recurrences. The type of hernia is obvious; trocar placement is identical for any side or hernia type, clear visualization of the anatomy. Routine video documentation renders the diagnostic accuracy objective and absolute.

Different techniques of laparoscopic repair have the same principle but it differs in the method of suture delivery and tie ligation either intracorporeal ligation or PCT delivery with extracorporeal ligation. These techniques include:

I-Laparoscopic repair.

II-Laparoscopic assisted PCT techniques (Needle assisted techniques).

III-Application of tissue adhesives.

This study is designed to compare between two different approaches to repair the inguinal hernia; the conventional open repair and laparoscopic assisted percutaneous repair of inguinal hernia using ordinary needle holder to deliver the suture.

Fifty children were gathered from outpatient surgery clinic of Benha University Hospital with 60 inguinal hernias, both males and females are included, between June 2009 and December 2009.

The patients selected for this study are from one year old to 6 years old. All patients were done on elective basis, no place for complicated inguinal hernia which requires urgent operation. Also, obese patients showing thick abdominal wall with marked subcutaneous fat deposition were excluded from this study.

All patients with inguinal hernia were randomly classified into 2 groups:

- Group A: treated by open inguinal approach.
- Group B: treated by needle assisted technique (needle holder technique).

In open approach of hernia repair, contralateral exploration of clinically negative side is experienced a great debate; to do or not to do? Surgeons agree with contralateral exploration; their strategy is to avoid second operation and second exposure to anesthesia especially when suspicion for contralateral hernia is significant as in patients presented with left sided hernia. On the other hand, surgeons running against this strategy of contralateral exploration depending on the high percentage of negative explorations, and even in those cases who presented with patent processus vaginalis, it is not a rule to develop inguinal hernia, considering contralateral exploration is a sort of over treatment exposing the patients to the hazards of prolonged anesthesia and the risk of injury to spermatic cord structures.

In this study, contralateral exploration is not done in the group (A); group of open repair, while in the other group; laparoscopic assisted PCT repair; contralateral exploration to other side was done routinely via the laparoscopic exploration; which was simple, safe and not time consuming or injurious procedure.

All patients of both groups had a scheduled follow up in the outpatient clinic of Benha University hospital after one week, one month and one year. In the follow up examination, we are searching for early postoperative complications in the form of wound sepsis, testicular edema. While examination for delayed complications we are searching for recurrence, contralateral hernia appearance, testicular atrophy, hydrocele and the scars.

On the other hand; exploratory laparoscopy was conducted for 20 patients of group "B" diagnosed clinically as having unilateral inguinal hernia and 5 of them were found to have contralateral hernia with a detection rate of 25 %. Similar figures for laparoscopic contralateral hernial detection rate were reported by similar studies.

Laparoscopic exploration of contralateral inguinal region did not impose prolongation of theater time and thus did not increase the risk or the cost and could be considered cost effective and spared unnecessary second inguinal surgery; a finding consistent with**.**

All patients showed no immediate postoperative complications with mild to moderate pain sensation that responded to non-steroidal anti-inflammatory drugs allowing patients' discharge after a mean postoperative hospital stay of 3.79 ± 2.28 hours for laparoscopic group and 4.3 ±1.5 for open hernia repair with non significant difference between both groups in the post operative hospital stay. Both approaches for inguinal hernia repair

included in this study; are considered as day-case coincided with that reported by.

The main factors affecting recurrence have been recognized as (1) failure to ligate the sac high enough at the internal ring; (2) injury to the floor of the inguinal canal due to operative trauma; (3) failure to close the internal ring in girls; and (4) postoperative wound infection and hematoma.

Laparoscopic technique has proven to be a method that can avoid all these possible causes of recurrence.

Through the current study, only one patient had recurrent hernia for a frequency of 4% for patients and 2.85% for repaired hernias. On re-operation of this case, the prolene stitch is found out of its planned site, which was considered as malpractice in early cases done in this study. So it is a defect in performance not in the technique itself. On spite of the above, the reported recurrence rate goes in hand with that previously reported.

The applied procedure was conducted through an extracorporeal approach to overcome the documented relatively high recurrence rate reported in laparoscopic hernia repair in children using intracorporeal suturing technique.

The injection of saline/local anesthetic mixture extraperitoneally at the site of the internal ring created a space to help identification of cord structures and facilitate the needle passage without endangering them. The procedure relied on under vision insertion of a threaded needle from skin directly to extraperitoneal space and after hernia reduction a piece-meal purse string stitching was conducted to include the peritoneal coverings at the internal ring and then the needle was extracted under vision at a site near

to the entrance site. The stitch was tightened under vision and the knot was buried subcutaneously.

This procedure was simpler and more advantageous, without the need for specially designed instruments, in comparison to *Tam et al.,* who used the hook method during hernia repair to allow extraperitoneal passage of suture to close the hernia sac without creating any tension or skip areas.

And the procedure does not require laparoscopic suturing skills; however, the procedure of *Endo et al.* who depended on a 2-0 suture, placed in the lower half of the internal inguinal ring through a l6-gauge sheath needle advanced extraperitoneally across the cord and vessels, was retrieved through the upper half of the ring by a specially devised needle and was tied up extra-corporeally, achieving completely extraperitoneal ligation of the ring. This procedure depended on specially devised needle and tying of the stitch extra-corporeally with fear of loosening so ***Endo et al.,*** thereafter modified their technique by double-ligation of the proximal end of the sac especially for infants younger than 1.5 years.

The current study presents a preliminary experience with inguinal hernial repair using single trocar. The obtained results in group (B) patients were comparable to ***Bharathi et al.***, who assessed the differences in outcome between the three-port technique and the single-port laparoscopically assisted ligation technique and found both are safe and efficacious day-case procedures and in the ligation of average-sized internal ring of thin patients, working ports may not be necessary, as single-port technique proves cosmetically and temporally efficacious.

However, patients with wide rings and thick anterior abdominal walls may need the placement of working ports for successful laparoscopic repair.

The current study tried to overcome such problem through inclusion of children within the average body mass index adjusted for sex and age so that obesity was not an obstacle for completion of repair of enrolled patients.

The obtained results of group (B) patients were contradictory to that obtained by ***Rothenberg et al.,*** who tried to determine the safety and efficacy of limited-access laparoscopic procedures in children by using a modified single-port access technique and found it safe, viable alternative to a standard laparoscopic approach for some procedures in children with the primary advantage is cosmetic, but visualization and tissue manipulation are more difficult and time consuming and the addition of a single 3-mm instrument at a separate site allows for easier dissection and triangulation, with almost no visible scarring. However, ***Rothenberg et al.*** described their experience using single port for various operative procedures without focusing on hernia repair, additionally through the current study operative time was comparable to that reported in literature for 3-port technique without significant difference and without difficulty in visualization during the procedure**.**

Conclusion

Laparoscopic assisted PCT closure of internal ring provides a rapid, easy, and accurate method for the treatment of congenital IH in children. We found this technique to be more simple, safe, and effective. It resulted in the shortening of the operative time and it can also be performed by surgeons, who are not specially trained in intracorporeal suturing and knot tying. The cosmetic results are excellent and better than conventional open technique. It also has diagnostic value for the hidden contralateral hernias saving the patient from a later surgery, as well as unnecessary routine bilateral open exploration. At 1-year-follow up, all patients were available and no single case of recurrence was reported. However, long-term follow up will be needed to determine the validity of these initial results and the rate of recurrence after a longer time.

The conventional open technique for inguinal hernia repair in pediatric age is still considered the gold standard in most of surgical schools. This study is trying to highlight another approach for pediatric inguinal hernia repair. These approaches carrying the advantage of minimal access surgery, saving time, non touching the inguinal canal contents or disturbing its anatomy, furthermore; the benefit of contralateral exploration without adding a new burden over operative time or tissue damage. The value of this study to deviate attention toward these new techniques of minimal access nature, trying to raise it up to become the new gold standard for pediatric

inguinal hernia repair.