

Laparoscopic Management of Ovarian Torsion in Children and Adolescent

Hanaa El-Ebeissy¹, Rafik Shalaby² and Ahmed Abd El Ghafar Helal.²

¹Obstetrics and Gynaecology and ²Paediatric Surgery Departments, Faculty of Medicine Al-Azhar University, Cairo, Egypt.

hanaaebeisy@yahoo.com

Abstract: Backgrounds: Ovarian torsion accounts for approximately 3% of cases of acute abdominal pain in pediatric population. The treatment of ovarian torsion is often delayed because of diagnostic uncertainty and dependence on radiologic confirmation. More urgent intervention for ovarian torsion should be considered in girls with lower abdominal pain. The purpose of this study is to present our experience with laparoscopic management for ovarian torsion in children and adolescent with a focus on the procedures of adnexal conservation surgery. **Patients and methods:** This is a retrospective study of 39 consecutive girls with ovarian torsion underwent laparoscopic management in the period from April 2010 to September 2012. Records of patients that have been subjected to laparoscopy for ovarian torsion were reviewed and evaluated. All patients were subjected to laparoscopic management of ovarian torsion. The main outcome measurements of this study included; feasibility, accuracy of laparoscopic management of ovarian torsion, operative time and intra and post-operative complications. **Results:** In this study 39 children with ovarian torsion were operated upon laparoscopically. Their mean age was 6.54 ± 1.82 years (range = 4 – 14 years). All procedures were completed laparoscopically without any conversion. In 32 (82.05%) cases the ovary can be saved with de-torsion and fixation, while in 7 (17.95%) cases, the ovary was gangrenous and removed. Associated ovarian cyst was present in 4 cases of ovarian torsion Mean operating time was 36 ± 2.3 minutes for unilateral and 45 ± 1.7 minutes for bilateral twisted ovary. All patients achieved full recovery without intra or postoperative complications and were discharged on the same day of admission. **Conclusion:** Laparoscopic management of children and adolescents presenting with adnexal torsion is feasible, safe and accurate method. It is a good alternative option to open methods in the management of adnexal lesions. Laparoscopic treatment of adnexal torsion in children and adolescent is as an emergency procedure and should be more conservative as possible to preserve the subsequent fertility.

[Hanaa El-Ebeissy, Rafik Shalaby and Ahmed Abd El Ghafar Helal. **Laparoscopic Management of Ovarian Torsion in Children and Adolescent.** *J Am Sci* 2014;10(7):56-61]. (ISSN: 1545-1003). <http://www.jofamericanscience.org>. 9

Keywords: Laparoscopy, Children and adolescent, Ovarian torsion, Ovarian preservation

1- Introduction

Ovarian torsion is the twisting of the ovary on its vascular support. It may involve a normal ovary or an ovary with functional pathology, benign or malignant neoplasm [1,2]. An abnormally long fallopian tube, mesosalpinx or mesoovarium cause an excess of mobility of the adnexa, determining a higher risk of torsion [3,4]. Ovarian torsion can occur at all ages, pediatric cases represent 15%, and the estimated incidence is 4.9/100,000 females aged 1–20 years. In children torsion on a normal ovary is more frequent because of the greater length of the ovarian pedicle [5,6,7,8].

Ovarian torsion in the pediatric population accounts for approximately 3% of cases of acute abdominal pain in children. It is important to make an immediate diagnosis and provide treatment in order to save the ovary. The clinical presentation of ovarian torsion is non-specific and, at the present time, there is no reliable method to confirm the diagnosis pre-operatively, and sometimes diagnosis is established during surgery [9,10]. Ovarian torsion in

premenarchal girls usually presents with intermittent abdominal pain and abdominal tenderness. Other signs and symptoms are nonspecific. When performed, Doppler imaging may assist in diagnosing ovarian torsion in children. [1]. More urgent intervention for ovarian torsion, with liberal use of diagnostic laparoscopy and without reliance on a definitive diagnosis by imaging, should be considered in girls with lower abdominal pain. Given the frequency with which ovarian torsion occurs, especially in patients older than 10 years, a high index of suspicion must be maintained when evaluating girls with lower abdominal pain. [11]

The treatment of ovarian torsion is often delayed because of diagnostic uncertainty and dependence on radiologic confirmation. The preferred treatment of confirmed ovarian torsion is still a matter of debate. Ovarian vitality in cases of ovarian torsion depends on the duration of time until the diagnosis is established, before necrosis occurs. When ovarian torsion remains undiagnosed, blood supply becomes compromised resulting in tissue

necrosis. A growing number of studies advocate conservative surgery (mainly detorsion with additional cyst drainage or cystectomy), but this approach mainly applies to the adult population. Detorsion followed by cystectomy may prevent recurrence [3,9,12,13].

The purpose of this study is to present our experience with laparoscopic treatment of ovarian torsion in children and adolescents with a focus on the procedures of adnexal conservation surgery.

2- Patients and Methods

This is a retrospective study of laparoscopic management of ovarian torsion in children and adolescent. It was conducted at the Paediatric Surgery and Obstetrics and Gynaecology Departments, Faculty of Medicine Al-Azhar University from April 2010 to September 2012. The study protocol was approved by the hospital ethical committee. Records of patients that have been subjected to laparoscopy for ovarian torsion were reviewed and evaluated regarding age, date of operation, presentation (right, left or bilateral), type of operation (excision or conservation). Clinical examination, trans-abdominal ultrasonography (US) and Color Doppler ultrasonography and standard abdominal X-Ray examinations have been performed in all patients. Computed Tomography (CT) for 10 patients, Magnetic Resonance Imaging (MRI) for 8 patients and evaluation of serum tumor markers (CA-125, α -FP, β -hCG and CA-19.9) for all patients. Surgical procedures were done by laparoscopy using either the conservative or the radical excision approach. All children treated conservatively underwent U/S follow-up at postoperative weeks 1, 4 and 8, then every 3 months up to 1 year. The main outcome measurements of this study included; feasibility, accuracy of laparoscopic management of ovarian torsion, operative time and intra and post-operative complications.

3- Operative procedure

After induction of general endotracheal tube anaesthesia, the patient was placed supine in Trendelenburg's position. Prophylactic intravenous antibiotic in the form of 3rd generation cephalosporin in a dose of 40 mg/kg body weight was given on the induction of anaesthesia.

Insertion of the main umbilical port was accomplished by the open method. Pneumoperitoneum was established to a pressure of 12 to 14 mm Hg. according to the age. Laparoscopy was started by initial visualization of the pelvis and both ovaries and adnexa. Two 3-mm accessory ports were inserted at the lateral borders of the rectus muscles on both sides at the level of the umbilicus.

Adnexal conservation treatment was practiced as detorsion alone or detorsion followed by subsequent surgical cystectomy if there is associated ovarian cyst [Fig.1] with ovarian tissue preservation and eventually oophoropexy. Laparoscopic oophoropexy were done for both twisted and normal ovaries after detorsion by plication of uteroovarian ligament [Fig.2]. In cases of definite gangrene of the adnexa and ovary, radical excision was applied [Fig.3] After the pneumoperitoneum was released, the ports were removed. The umbilical wound was closed with absorbable sutures and the lateral ones with steri-strips.

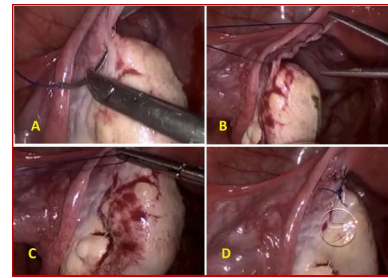


Fig. 1- Fixation of a normal contralateral ovary



Fig. 2 Specimen of huge ovarian cyst



Fig.3 Twisted ovarian cyst

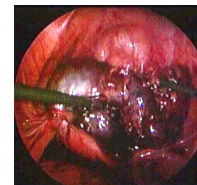


Fig.4- Twisted gangrenous ovarian cyst

4- Results: In this study a total of 39 girls with ovarian torsion were operated upon laparoscopically. Their mean age was 6.54 ± 1.82 years (range = 4.5 – 14 years). The main presenting symptoms were sudden acute lower abdominal pain in 30 cases

(76.92%); cyclic pain was present in 16 cases (41.02%); nausea and vomiting occurred in 21 cases (53.84%) and 8 cases (20.51%) presented with fever. Seven cases presented with leukocytosis. Torsion occurred on the right side in 27 cases (69.23%) and on the left side in 9 cases (23.07%) and 3 cases (7.69%) involved recurrent torsion after previous detorsion without cystectomy and without fixation. The demographic data of all patients are shown in [Table 1].

Imaging studies of patients with ovarian torsion included transabdominal and color Doppler US was done in all cases. Six patients underwent Doppler examinations demonstrated an abnormal flow. Ovarian enlargement and the presence of small cystic structures around the periphery of the ovary were the U/S appearance of the ovarian torsion of normal ovaries. Free fluid in Douglas Pouch was present in (38%) of cases. Associated ovarian cyst was present in 4 cases of ovarian torsion. All procedures were completed laparoscopically without any conversion. The laparoscopic conservative management, mainly detorsion with additional cyst drainage or cystectomy and fixation, was performed in 32 cases (82.05%). In their final evaluation at 4 and 8 months after the operation, they were found to have good ovarian function. In 7 cases (17.95%) who were treated 1 to 3 days after symptoms developed the ovary was gangrenous and oophorectomy was performed and pathologic examination of the resected ovary revealed the absence of viable ovarian tissue in these patients. Mean operating time was 36 ± 2.3 minutes for unilateral and 45 ± 1.7 minutes for bilateral ovarian torsion. All patients achieved full recovery without intra or postoperative complications and were discharged on the evening of the same day of admission. [Tab. 1].

Table 1: Demographic data of all patients

Demographic data	No. of patients	%
<i>Age per year</i>		
4-6	4	10.25 %
7-8	7	17.94 %
9-13	11	28.20 %
14	16	41.02 %
<i>Mean age</i>	6.54±1.98 years	
<i>Presentations</i>		
<i>Lower Abdominal Pain</i>	30	76.92%
<i>Vomiting</i>	21	53.84%
<i>Cyclic pain</i>	16	41.02%
<i>Fever</i>	8	20.51%
<i>Leucocytosis</i>	7	17.94%
<i>Recurrent torsion</i>	3	7.89 %

5- Discussion

Ovarian torsion results from partial or complete twisting of the ovarian pedicle on its axis. It can

occur at all ages, pediatric cases represent the 15% and the estimated incidence is 4.9/100,000 females aged 1–20 years [5,6]. The twisting of the ovary may involve a normal ovary or an ovary with functional pathology, benign or malignant neoplasm [1,2]. In children torsion on a normal ovary is more frequent because of the greater length of the ovarian pedicle [7,8]. The subsequent vascular compromise causes congestion of the ovarian parenchyma and leads to hemorrhagic infarction [14]. The diagnosis of adnexal torsion is often difficult, and some ovarian torsion was diagnosed preoperatively in only 37% to 50% of cases [15,16]. There are often significant delays between the onset of symptoms and hospital presentation, and from hospital presentation to operative intervention. The most likely explanation for these difficulties is the nonspecific nature of the symptoms and signs associated with this diagnosis [2,4,16].

The most frequent symptom of adnexal disease is usually an acute abdomen in which the main complaint is only nonspecific lower abdominal pain. If there is right lower abdominal pain, the differential diagnosis from acute appendicitis is extremely difficult. The symptoms that will allow accurate diagnosis become even more complicated if there is left lower abdominal pain. Furthermore, if the patient is a young girl, the probability of consultation with a gynecologist from the beginning is low, and a significant delay in diagnosis and surgical treatment occurs more frequently than with adult patients. Ovarian torsion accounts for approximately 3% of cases of acute abdominal pain in pediatric population. More urgent intervention for ovarian torsion should be considered in girls with lower abdominal pain [6]. **Darrell L. Cass D.L** [13], Stated that the most common symptoms of children with ovarian torsion are pain, nausea and vomiting. They added that although nearly all children with ovarian torsion have pain, not all have the classic history of sudden onset pain, followed by colicky persistent pain. [17,18]. There are some features in clinical presentation that may be helpful in distinguishing ovarian torsion from other diagnostic possibilities. In children with ovarian torsion, nausea and vomiting usually are coincident with the onset of pain, whereas with appendicitis these symptoms usually follow the pain onset by several hours. In our series of patients with ovarian torsion, acute abdominal pain and vomiting were found in 74% and 65%, respectively. Tenderness, the palpation of a mass, and fever are the most common signs found in children with ovarian torsion. Whereas fever is common in girls with appendicitis, it is less common with ovarian torsion, and may be associated with more advanced cases and a higher risk of tissue necrosis [19]. Ovarian torsion may present in an

incarcerated inguinal hernia. **Merriman** reviewed 71 cases of irreducible hernias in girls and found that in 82% the hernias contained ovaries, and 11 had torsion. [19] **Boley** found that 27% of girls with incarcerated hernia had ovarian torsion with infarction. [20]

Yancey stated that ovarian torsion usually occurs in the presence of ovarian or pelvic pathology. He described a 12-year-old girl presented with intermittent abdominal pain lasting nearly 6 months, and was ultimately diagnosed as intermittent ovarian torsion of an otherwise normal ovary. Surgery confirmed the ovary to be twisted 180 degrees and markedly oedematous. After surgery, she had had no recurrence of her symptoms [7].

Preoperative diagnosis of adnexal torsion often is difficult [21-23]. Persistent abdominal pain may be the only complaint in the pediatric population [2,10]. Radiologic surveys of the abdomen will not reveal the condition but may be useful to exclude other causes of abdominal pain [5]. In view of these problems U/S studies are recommended in prompt diagnosis. [7]. Conventional U/S usually confirms a pelvic mass in cases of adnexal torsion but may not establish the diagnosis [23,24]. However, Doppler U/S may be useful in the diagnosis of ovarian torsion. However, when normal flow is detected by Doppler U/S, it does not exclude an ovarian torsion, in fact, torsion may be missed in these cases resulting a delay in diagnosis and surgical intervention [25]. Possible explanation for a normal flow on Doppler U/S in cases of ovarian torsion include (1) venous thrombosis leads to ovarian necrosis before arterial thrombosis occurs, (2) continuing arterial flow to ovary from the branches of uterine artery, and (3) intermittent ovarian torsion: the results of Doppler U/S varies whether the adnexa is twisted at the time the study is performed.

With advances in operative laparoscopic procedures and the development of surgical equipments, the indications for laparoscopic surgery in the field of gynecology have expanded in recent years. It provides the potential for improved cosmetic visualization, shorter hospital stay, reduced postoperative pain, and earlier postoperative return to daily activities. Therefore, the application of laparoscopic procedures for the treatment of gynecologic disorders in young girls during maturation would be highly desirable [14].

A sure and certain diagnosis of adnexal torsion can be made only by laparoscopy. Surgical treatment for adnexal torsion should take place as an emergency in order to avoid any complications with a detrimental effect on their subsequent fertility. When adnexal torsion is suspected and diagnosis can only be achieved by surgery, arrangements should be

made for laparoscopy as soon as possible. The interruption in the arterial blood supply may be the initial consequence of the adnexal torsion, or develop secondarily to an interruption in the venous flow due to the edema created [26].

Given the very low likelihood of a malignancy within the ovary, the current recommendation is to leave the ovary in situ and follow-up with US several weeks postoperatively. If the ovary does not return to normal size and structure and if there is concern for an underlying mass lesion, further investigations and possibly surgery would be warranted. Recent evidence is also emerging to suggest that many ovaries that appear completely ischemic at the time of acute torsion will regain normal follicular development, again lending support to leaving the ovary in situ. In a study by **Oelsner et al.**, 102 patients with ovarian torsion underwent surgery with ovarian preservation. All patients were noted to have blue/black adnexa, consistent with necrosis, at the time of surgery and subsequently had a normal ovarian size and follicular development in 90% of these patients [9]. Additional studies have found similar encouraging results after ovarian detorsion with 88% to 94% of patients regaining follicular development in the affected ovary [15].

The resection of the affected adnexa can have a negative impact on fertility, especially in case of recurrence or bilaterality [19], while adnexal conservation surgery, performed as soon as possible, seems to be the best surgical approach in order to maximize the future reproductive potential of the girl. The danger of missing malignant pathology and the fear that a severe ischemic ovary is non-viable, have led the use of oophorectomy [27,28]. **Spinelli et al.**, stated that several studies show a low risk of malignancy and thromboembolism associated with ovarian torsion, and that the macroscopic appearance of ovary is not a true indicator of the degree of ischemia [5].

Detorsion and oophoropexy in unilateral torsion in children even in delayed diagnosis had been recommended by **Templeman et al.**, [27] and **Dolgin et al** [29] with a good clinical and U/S results. In our series and in accordance with other reports ovarian torsion occurred more frequently on the right side in the patients of our study group, with a ratio of about 7:3. This tendency has been attributed to the presence of the sigmoid colon on the left side, which may help to prevent left-sided torsion [10,12,13].

Takeda et al., stated that functional preservation of adnexal tissue is one of the important purposes of surgery for adnexal disease in young girls, detorsion of twisted adnexa should be positively carried out first, and the grade of blood-flow return should be carefully assessed by change in

color degree. It then should be determined whether to proceed with adnexectomy or cystectomy [15]. However, at present, a consensus has not been reached regarding whether there is a time limit after the onset of symptoms or what the intraoperative findings for adnexectomy should be [14,29]. In our patients with adnexal torsion, adnexal preservation was possible only in 32 cases that underwent surgery 8 hours after symptom onset. However, in other 7 neglected patients who were presented within 2 -3 days after symptoms developed, the preservation of adnexal tissue was difficult, and pathologic examination of the resected adnexa and ovary revealed the absence of viable ovarian tissue [Fig. 4]. There is an inverse relationship between the time interval from admission to diagnosis and to performing conservative surgery. [3]. The average time interval from the onset of pain to surgery in our patients was 54.5 hours (median interval 20.75 hours). It is perhaps this relatively short interval that aided us in the decision to perform conservative surgery, in accordance with the data presented by **Rousseau et al.**, [3]. We had 7 cases where radical surgery was performed admitted 73 hours after onset of pain caused by irreversible necrosis with pathologic report of hemorrhagic necrosis. There were 3 cases of recurrent ovarian torsion in our series, 2 after detorsion alone and 1 after detorsion and cyst drainage. The first recurrence was in a girl 12-year-old 24 months after laparoscopic detorsion of a normal appearing ovary. The recurrence was due to an 8-cm ovarian cyst that was removed with oophoropexy. Oophoropexy was performed by plication of uteroovarian ligament. The second case of recurrence was in a 14-year-old girl 8 month after laparoscopic detorsion and aspiration of 5-cmm ovarian cyst. The recurrence was due to an 11-cm ovarian cyst that was removed by laparoscopic cystectomy.

Spinelli et al., did a retrospective study on 127 cases of ovarian lesions in the form of 30 ovarian torsions (23.6%) with a mean age of 13.7 years. Conservative surgery has been performed in 46.7% of the cases and laparoscopic approach in 40%. Ovarian torsion occurred in 56.7% on ovaries with functional lesion, in 23.3% on normal adnexa and in 20% on ovaries with benign neoplasm. Literature review shows 40.5% normal adnexa, 33.2% non-neoplastic lesions, 25.3% benign neoplasms and 1% malignant neoplasms. They concluded that the surgical treatment of children and adolescents presenting with adnexal torsion should be more conservative as possible in order to maximize the future fertility [5].

Piper et al., followed the following steps to improve the outcomes for ovarian torsion. The first step is to maintain a high index of suspicion in female patients

who complain of lower abdominal pain. Second, the ovaries should be included in the evaluation with whatever imaging modality is chosen (US to evaluate the appendix, and both ovaries is usually the best initial study) so that additional time is not wasted going back for subsequent imaging. Third, if significant pain persists, early laparoscopic intervention should be considered because 17% of girls in this study had no ovarian enlargement reported on US. Lastly, motivation to save the ovary must be present even if the ovary is necrotic in appearance [11].

Conclusion:

Laparoscopic management of children and adolescents presenting with adnexal torsion is feasible, safe and accurate method. It is a good alternative option to open methods in the management of adnexal lesions. Laparoscopic treatment of adnexal torsion in children and adolescent is as an emergency procedure and should be more conservative as possible to preserve the subsequent fertility.

Corresponding author:

Dr. Hanaa El-Ebeissy,
Obstetrics and Gynaecology, Faculty of Medicine Al-Azhar University, Cairo, Egypt.

References

1. Oltmann SC, Fischer A, Barber R, *et al.* Can not exclude torsion—a 15-year review. *J Pediatr Surg* 2009;44:1212-6.
2. Aziz D, Davis V, Allen L, *et al.* Ovarian torsion in children: is oophorectomy necessary? *J Pediatr Surg* 2004;39:750-3.
3. Rousseau V, Massicot R, Dwarish AA, *et al.* Emergency management and conservative surgery of ovarian torsion in children: a report of 40 cases. *J Pediatr Adolesc Gynecol.* 2008;21:201-6.
4. Beaunoyer M, Chapdelaine J, Bouchard S, *et al.* Asynchronous bilateral ovarian torsion. *J Pediatr Surg* 2004;39:746-9.
5. Spinelli C, Buti I, Pucci V *et al.* Adnexal torsion in children and adolescents: new trends to conservative surgical approach - our experience and review of literature. *Gynecol Endocrinol.* 2013;29:54-8.
6. Guthrie BD, Adler MD, Powell EC. Incidence and trends of pediatric ovarian torsion hospitalizations in the United States, 2000-2006. *Pediatrics* 2010;125:532-8.
7. Yancey LM. Intermittent torsion of a normal ovary in a child associated with use of a trampoline. *J Emerg Med* 2012;42:409-12.

8. Svensson JF, Larsson A, Uusijärvi J *et al.* Oophoropexy, hyperbaric oxygen therapy, and contrast-enhanced ultrasound after asynchronous bilateral ovarian torsion. *J Pediatr Surg* 2008;43:1380–4.
9. Oelner G, Cohen SB, Soriano D. *et al.* Minimal surgery for the twisted ischaemic adnexa can preserve ovarian function. *Hum Reprod.* 2003;18:2599-602.
10. Servaes S, Zurakowski D, Laufer MR *et al.* Sonographic findings of ovarian torsion in children. *Pediatr Radiol.* 2007;37:446–51.
11. Piper HG, Oltmann SC, Xu L. *et al.* Ovarian torsion: diagnosis of inclusion mandates earlier intervention. *J. Pediatr. Surg.* 2012; 47: 2071–6.
12. Tsafirir Z, Hasson J, Levin I, *et al.* Adnexal torsion: cystectomy and ovarian fixation are equally important in preventing recurrence. *Eur J Obstet Gynecol Reprod Biol.* 2012;162:203-5.
13. Darrell L. Ovarian torsion. *Semin Pediatr Surg.* 2005;14:86–92.
14. Takeda. A, Manabe. S, Hosonoet. S *et al.* Laparoscopic surgery in 12 cases of adnexal disease occurring in girls aged 15 years or younger. *Journal of Minimally Invasive Gynecology.* 2005;12: 234-40.
15. P, Abargil A, Dreazen E, *et al.* Conservative management of adnexal torsion in premenarchal girls. *J Am Assoc Gynecol Laparosc.* 2000;7:121-4.
16. Kokoska ER, Keller MS, Weber TR. Acute ovarian torsion in children. *Am J Surg* 2000;180:462-5.
17. Ozcan C, Celik A, Ozok G, *et al.* Adnexal torsion in children may have a catastrophic sequel: asynchronous bilateral torsion. *J Pediatr Surg* 2002;37:1617-20.
18. Houry D, Abbott JT. Ovarian torsion: a fifteen-year review. *Ann Emerg Med* 2001;38:156-9.
19. Merriman TE, Auldism AW. Ovarian torsion in inguinal hernias. *Pe-diatr Surg Int* 2000;16:383-5.
20. Boley SJ, Cahn D, Lauer T, *et al.* The irreducible ovary: a true emergency. *J Pediatr Surg.* 1991;26:1035-8
21. Spigland N, Ducharme JC, Yazbeck S: Adnexal torsion in children. *J Pediatr Surg* 1989;24:974-6.
22. Germain M, Rarick T, Robins E: Management of intermittent ovarian torsion by laparoscopic oophoropexy. *Obstet Gynecol.*1996;88:715-7.
23. Eckler K, Laufer MR, Perlman SE: Conservative management of bilateral asynchronous adnexal torsion with necrosis in a prepubescent girl. *J Pediatr Surg.* 2000;35:1248-51.
24. Quillin SP, Siegel MJ: Transabdominal color Doppler ultrasonography of the painful adolescent ovary. *J Ultrasound Med.* 1994;13:549- 55.
25. Penã JE, Ufberg D, Cooney N, *et al.*: Usefulness of Doppler sonography in the diagnosis of ovarian torsion. *Fertil Steril.* 2000;73:1047-50.
26. H, Fauconnier A. Adnexal torsion: a literature review. *Eur J Obstet Gynecol Reprod Biol.* 2010;150:8-12.
27. Templeman C, Hertweck SP, Fallat ME. The clinical course of un-resected ovarian torsion. *J Pediatr Surg.* 2000;35:1385-7.
28. Savic D, Stankovic ZB, Djukic M. *et al.* Torsion of malignant ovarian tumors in childhood and adolescence. *J Pediatr Endocrinol Metab* 2008;21:1073–8.
29. Dolgin SE, Lublin M, Shlasko E. Maximizing ovarian salvage when treating idiopathic adnexal torsion. *J Pediatr Surg.* 2000;35:624-6.

5/6/2014