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APPROACH TO ADNEXAL TORSION IN CHILDREN AND ADOLESCENTS

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Introduction

Hello team,
My name is Damian Feldman-Kiss, and I am a medical student at the University of British Columbia. Today, we are going to discuss the approach to adnexal torsion in children and adolescents. This podcast was developed under the supervision of Dr. Jason Wale, an Emergency Physician in Victoria and Clinical Assistant Professor at UBC. This podcast will focus on the approach to torsion in the acute care setting. This podcast is based primarily on three references. They are:

- A 2019 Committee Opinion paper by the American College of Obstetricians and Gynecologists.
- A 2017 Clinical Practice Guideline by The Society of Obstetricians and Gynaecologists of Canada.
- Tintinalli's Emergency Medicine Manual.

Learning Objectives

In terms of objectives, at the end of this podcast, you will be able to:

1. Define adnexal torsion.
2. Discuss the anatomy and pathophysiology of torsion.
3. List the most common clinical features of torsion and the two most critical diagnoses to rule out.
4. State the key test in the workup of torsion.
5. Discuss the recommended approach to the treatment of torsion.

Case: Introduction

Let's start with a case. You're on an emergency medicine rotation in Victoria, and the triage note of your next chart reads:

"17-year-old female with a 2-hour history of sudden-onset of severe RLQ abdominal pain associated with nausea, vomiting, and presyncope. No vaginal or urinary symptoms."

The patient's name is Odessa Taylor, and the vital signs completed at triage were:

Blood Pressure: 126/86
Heart Rate: 108
Respiratory Rate: 18
Temperature: 37.1°C
SpO2: 100% on room air

Next, you briefly review Odessa's electronic medical record (EMR). You see no prior visits to the emergency department (ED), and you note that the β-hCG is pending. Before visiting the patient, you think of an initial differential diagnosis, including the critical diagnoses that you must rule out. Your initial differential includes the following: ectopic pregnancy, ovarian torsion, appendicitis, ovarian cyst, pelvic inflammatory disease (PID), and urolithiasis.

Before we hear about the patient encounter, let's discuss the definition, epidemiology, anatomy, pathophysiology, and risk factors for torsion.

Definition [1,2,3]

Adnexal torsion is the partial or complete rotation of normal and/or abnormal structures of the uterine adnexa on the vascular pedicle leading to impaired blood flow. The uterine adnexa contains the ovaries, uterine tubes, and supporting structures.

Epidemiology [1,2]

Torsion is the fifth most common gynecologic emergency. More common gynecologic emergencies include ectopic pregnancy and PID. Children, adolescents, and young adult females are most commonly affected. The average age is 26 years, with 30% occurring below the age of 20 years. Approximately 5 in 100,000 females aged 1 to 20 will experience torsion. Females older than 10 have an increased risk due to pubertal changes that result in an increased frequency of physiologic and pathologic pelvic masses compared to prepubescent females. These masses become a concerning risk factor for torsion when they exceed 5 cm.

Anatomy [3,4]

There are a few ligaments and a key blood vessel to remember from the gross anatomy lab that have clinical relevance to torsion. These include the suspensory ligament of the ovary, the ovarian ligament, the broad ligament, and the ovarian artery.

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- The suspensory ligament of the ovary (also referred to as the infundibulopelvic ligament) attaches the superior pole of the ovary to the lateral pelvic wall.
- The ovarian ligament (also referred to as the utero-ovarian ligament) attaches the inferior pole of the ovary to the lateral aspect of the uterus.
- The broad ligament is a composite structure comprising the mesometrium, mesosalpinx, and mesovarium. It is a sheet of peritoneum that envelops the uterus, uterine tubes, and hila of the ovaries.
- The ovarian artery arises from the abdominal aorta between L2 and L3. Importantly, the ovarian artery travels along the suspensory ligament to supply the ovary. It travels in a neurovascular bundle with its associated vein, lymphatic, and nerve and sends branches through the mesovarium to supply the ovary before travelling through the mesometrium to anastomose with the uterine artery. This means that the ovaries have a dual blood supply.

Something that might not have been so apparent in the gross anatomy lab that is also relevant to the pathophysiology of torsion is that the ovaries are not fixed but in fact, suspended in the pelvis. Depending on body position and gravity, the ovaries may drift to and from lateral and posterolateral to the uterus. This anatomic feature makes them susceptible to torsion.

Pathophysiology [1,2,3]

The pathophysiology of ovarian torsion involves the ovary rotating around the suspensory ligament and ovarian ligament. When the uterine tube rotates as well, it is referred to as adnexal torsion. Isolated tubal torsion can also occur, but it is rare in pediatrics.

The majority of torsions occur on the right side. It is thought that the descending colon decreases the tendency of the left adnexa to rotate, thereby protecting against torsion.

Rotation increases resistance to venous flow leading to venous congestion. This, in turn, causes adnexal swelling and edema and increases resistance to arterial flow leading to ischemia, infarction, and, ultimately, necrosis.

Unfortunately, the precise duration of ischemia that causes infarction is unknown. Nevertheless, the sooner the ischemia is reversed, the better. Therefore, the expressions ‘time is brain’ and ‘time is myocardium’ in acute stroke and myocardial infarction (MI) care, respectively, translate reasonably well in ovarian torsion to ‘time is ovary.’ That being said, restoring blood flow is not as urgent in torsion as it is in a stroke or an MI.

Risk Factors [1,2]

The risk factors for developing torsion can be broadly understood as changes from normal pelvic anatomy. However, these changes are not necessary, and torsion can

develop from completely normal anatomy. Risk factors for torsion in pediatrics include adnexal masses, ligamentous differences, a relatively small uterus, tubal pathology, and a history of torsion.

- An adnexal mass is found in the majority of adult cases. However, pediatric cases are actually free from pathologic structures in up to 50% of confirmed cases. When abnormal structures are found, benign functional ovarian cysts (25%) and benign teratomas (30%) are the most common. Malignant lesions are rare and found in up to 6% of pediatric cases.
- A congenitally long ovarian ligament or abnormal laxity of the ovarian ligament and/or the suspensory ligament may increase the risk of torsion.
- A relatively small uterus may also increase the risk by providing more space for the adnexa to twist on its axis.
- As mentioned earlier, isolated tubal torsion is rare in pediatrics, but tends to be associated with pathology of the uterine tube including hydrosalpinx and a paratubular cyst.

Case: History and Physical

You find Odessa in an acute care bed. Before approaching her bedside, you note that her ABCs appear to be intact. On the monitor, her blood pressure, rhythm, and oxygen saturation are all within normal limits. However, she is still a bit tachycardic, hovering around 102. She appears slightly pale, anxious, and in pain, with her hands on her belly. Given that she does not appear to need immediate resuscitation, you decide to proceed with a focused history and physical exam.

Odessa tells you that the pain came on suddenly a few hours ago at dance class after school. She feels very nauseous and vomited three times before leaving the dance studio. Odessa felt lightheaded when the pain started but she didn't faint. Her dance instructor said she also looked very pale. The pain is severe and feels sharp. She points to the right lower quadrant (RLQ) as being the most painful spot and says it doesn't radiate. The pain has come and gone multiple times since onset, and it's worse with movement. She has never experienced an event like this before.

With your differential in mind, you ask some targeted questions. Odessa's last menstrual period was three weeks ago, and she has been sexually active with one female partner for the last six months. She has no fever or chills and has not eaten since the onset of the pain. She has eaten normally over the preceding days with no changes in bowel movements. She has never had abdominal or gynecologic surgery and still has her appendix. As far as she knows, she has never had an ovarian cyst or kidney stone. She does not endorse the vaginal and urinary symptoms of discharge, bleeding, itchiness, dyspareunia, frequency, dysuria, urgency, or hematuria.

Odessa's past medical history is unremarkable. She takes no medications and has no known drug allergies. She doesn't smoke or consume illicit drugs, but she does have two to three drinks a few times a month with friends.

On exam, Odessa appears to be in pain, but is talkative and is not in acute distress. Her vitals have been stable since you got to her bedside with her heart rate hovering around 100. Her pulses are present and regular in all four extremities. Heart sounds and lung sounds are normal to auscultation. Her abdomen is soft but very tender with the most tender spot localizing to the RLQ. There is no hepatosplenomegaly. McBurney's, obturator, and psoas signs appear positive. However, Rovsing's sign is negative, and there is no rebound tenderness. Murphy's sign is also negative, and there is no costovertebral angle (CVA) tenderness.

After the history and exam, you return to your workstation to find your preceptor. Before we hear about the next steps in the case, let's discuss the clinical features and differential diagnosis of torsion.

Clinical Features [1,2,5]

Torsion most commonly presents as sudden onset, severe, unilateral lower abdominal pain that is stabbing or sharp, intermittent, and non-radiating. Recall that the right adnexa is more commonly affected than the left. Therefore, lower abdominal pain localizes to the RLQ more often than the left. The intermittency of the pain is thought to be related to repetitive sequences of partial adnexal rotation and spontaneous reversal. However, abating pain after a course of severe discomfort can suggest death of the ovary. Intermittent abdominal pain over the preceding few months is also often noted on history.

Torsion tends to be associated with severe nausea, vomiting, and presyncope. These features are caused by direct vagal nerve stimulation. Nausea and vomiting more often occur in premenarchal patients. Importantly, nausea and vomiting are more commonly reported in pediatric and adolescent patients with torsion than with an ovarian cyst alone. Exertion preceding the onset of the pain might also be described on history.

On physical exam, the patient could be febrile, but this is a rare and late finding as fever is due to necrotic adnexal tissue. Tachycardia may also be noted, and patients can appear pale. Abdominal tenderness is present in the vast majority of cases with the most tender location frequently localizing to the RLQ. This can lead to some mimicry of appendicitis; however, rebound tenderness and peritoneal signs are much less common in torsion. Depending on the extent of the swelling, an adnexal mass may also be palpable. That being said, a bimanual examination is generally not appropriate in pediatric patients.

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Differential Diagnosis [1,2,5]

Importantly, the clinical features of torsion are non-specific, and it can mimic other pathologies. Therefore, it is crucial to rule out other possible diagnoses with a solid workup. The differential of acute abdominal pain is broad and depends on many factors, including age, sex, and the ability to be pregnant. Key diagnoses to rule out when ovarian torsion is being considered in the pediatric female include, but are not limited to, ectopic pregnancy, appendicitis, PID, ovarian cyst, and urolithiasis. The most critical of which are ectopic pregnancy and appendicitis. It is beyond the scope of this podcast to review each of these diagnoses in detail. However, we will go over brief descriptions of each and a few discriminating features to help differentiate them from torsion.

- Ectopic pregnancy presents on a spectrum from relatively minor and diffuse abdominal pain to sudden onset, unilateral, severe abdominal pain with possible referred pain to the upper abdomen or shoulder. This referred pain results from rupture of the ectopic leading to hemoperitoneum and irritation of the diaphragm. Hemoperitoneum may also cause hypotension and relative bradycardia due to vagal stimulation. Discriminating features include vaginal bleeding and amenorrhea.
- Appendicitis classically presents as a gradual onset of abdominal pain that begins in the periumbilical and/or epigastric regions and then localizes to the RLQ as peritoneal irritation occurs. Discriminating features of appendicitis include rebound tenderness, guarding, and rigidity.
- PID is commonly asymptomatic. Even when symptomatic, patients may have subtle or nonspecific symptoms. Discriminating features include fever, cervical motion tenderness, and mucopurulent cervical discharge.
- Ovarian cysts are an excellent mimicker of both ovarian torsion and appendicitis. They present as sudden onset, unilateral, lower abdominal pain that may be associated with nausea and vomiting. Discriminating features of ovarian cysts include constant or progressive pain (i.e., not intermittent pain as can be the case in torsion) and less severe pain, nausea, and vomiting than in torsion.
- Urolithiasis presents as a sudden onset of sharp, episodic, severe pain that typically originates in the flank and radiates around the lower abdomen. However, the localization of the pain depends on the location of the stone. Discriminating features of urolithiasis include the pattern of radiation, dysuria, and hematuria. In fact, up to 30% of children have only painless hematuria.

Case: Presentation and Next Steps

Back at the workstation, you note that Odessa's β-hCG is negative, as expected. Next, you review the case with your preceptor and present your differential diagnosis. Given the pain presentation and acute onset, ovarian torsion and ovarian cyst are at the top of your differential. You're also considering appendicitis given the positive McBurney's, obturator, and psoas signs on physical exam. However, the acute onset of localized pain and absence of Rovsing's, rebound tenderness, guarding, and rigidity argue

against it. Urolithiasis is also possible, but the absence of urinary symptoms and no history of stones make it less likely. You think ectopic and PID are unlikely given Odessa's sexual history.

Your preceptor asks you what you'd like to do next. Given the top three diagnoses on your differential, you suggest transabdominal ultrasonography as the best place to start. Ultrasound should help differentiate ovarian torsion, ovarian cyst, and appendicitis and spare your patient the radiation of an abdominal CT. You'd also like to order a CBC and urinalysis as they could provide some evidence on the likelihood of appendicitis or urolithiasis, respectively. However, you concede that these tests are not very sensitive or specific. It would also be prudent to assess kidney function in case the ultrasound is non-diagnostic, and a CT with contrast is required. Finally, you suggest giving Odessa some ketorolac and ondansetron to control her pain and nausea, respectively. If ketorolac isn't adequate, you could also try morphine or fentanyl. Your preceptor agrees with your plan, and you return to Odessa's bed to give her an update.

Before we hear about the results, let's discuss the use of laboratory investigations and imaging in the workup of torsion.

Laboratory Investigations [1,2]

Common labs that are ordered in the ED, such as β-hCG, CBC, and c-reactive protein (CRP), are neither sensitive nor specific for torsion. However, these tests can be helpful in the workup of acute abdominal pain in a young female. For example, what is the first and most important test to order in a female of reproductive age presenting with abdominal pain? The answer is, of course, β-hCG (also referred to as a 'beta'). A negative beta will rule out pregnancy, and, more critically, an ectopic pregnancy, but it will give no direct information on the likelihood of torsion. Furthermore, an elevated white blood cell (WBC) count and CRP might be present in torsion, but neither test is sensitive or specific. In fact, an elevated WBC count and CRP are actually more suggestive of appendicitis.

Imaging [1,2,6]

Imaging, on the other hand, is more helpful. The imaging modality of choice in the workup of torsion is transabdominal ultrasonography (TAU). It is both highly sensitive and specific, at 92% and 96%, respectively. Transvaginal ultrasonography might be even better, but it is often not appropriate in pediatric patients. Findings on TAU that are suggestive of ovarian torsion include the following:

- unilateral ovarian enlargement, with, according to one study, the affected ovary being on average 12 times larger than the normal ovary
- ovarian edema, which is characterized by a hyperechogenic (or brighter) ovary with peripherally displaced follicles and an echogenic stroma
- free fluid, and

- a coiled vascular pedicle (known in radiology as the “whirlpool sign”)

There has been some controversy about the utility of Doppler ultrasonography in the workup of torsion. Overall, it has a low sensitivity and is of limited value. Preservation of blood flow in the presence of torsion can be explained by the following:

- intermittent torsion
- arterial blood flow from collateral supply, or
- a torsed paratubal cyst

CT and MRI are also used in the emergent workup of abdominal pain, and findings in these imaging modalities may also be suggestive of torsion. Nevertheless, if CT or MRI suggest torsion, consulting gynecology and arranging emergent surgery should not be delayed for TAU. Findings on CT that are suggestive of torsion include the following:

- asymmetric ovarian enlargement
- uterine deviation toward the abnormal side
- free fluid in the pelvis, and
- fat stranding, which is an increase in the attenuation or brightness of adipose tissue, adjacent to the ovary

Findings on MRI that are suggestive of torsion include the following:

- decreased ovarian enhancement after contrast
- asymmetric ovarian enlargement
- uterine deviation toward the abnormal side, and
- multiple small peripherally located follicles

Case: Results and Conclusion

Back at the workstation, the results are ready. Odessa’s ultrasound report shows right ovarian enlargement, edema, and the whirlpool sign and a normal-appearing appendix. The CBC is normal except for a mild elevation in her WBC count. Her urinalysis is also normal except for positive leukocyte esterase. Given these findings, you and your preceptor conclude that ovarian torsion is the most likely diagnosis and decide that an urgent gynecology consultation is necessary. You consult gynecology using SBAR and then admit Odessa to their service. Next, you return to Odessa’s bed to update her on the results, assess her pain and nausea, and explain the likely next steps in her care.

That concludes our case. Now, let’s discuss the gynecologic management of ovarian torsion.

Management [1,2]

Although imaging can be helpful, the definitive diagnosis of torsion is surgical. The preferred surgical approach is diagnostic laparoscopy because it is minimally invasive. There are a few important considerations when performing laparoscopy in children and adolescents. These include the following:

- The strength of the abdominal fascia and, therefore, the pressure necessary to puncture the abdominal wall increases with age during adolescence. Applying too much pressure risks injuring the underlying structures.
- The pediatric abdomen can be much smaller than that in adults, which leaves large vessels like the aorta and inferior vena cava more susceptible to injury if their location is not carefully considered when entering the abdomen.
- The maximum abdominal distention pressure is lower in children and adolescents than in adults. Therefore, insufflation, which is basically inflating the abdomen to better visualize and manipulate the anatomy, must be done at lower pressures.

The recommended treatment of torsion is prompt laparoscopic detorsion (i.e., untwisting) with or without concomitant cystectomy (i.e., cyst removal). Importantly, oophorectomy is not recommended because the appearance of the ovary during surgery does not necessarily predict future viability. For example, unless the ovary is necrotic, a black and blue ovary might regain normal function after detorsion. Prompt detorsion minimizes adnexal trauma and ischemia and, when performed under 24 hours of symptom onset, results in decreased oophorectomy and/or salpingectomy. Given this window, if a patient is diagnosed with torsion by imaging in the middle of the night, surgery need not happen immediately, but can wait until morning. A similar principle applies to ordering the TAU discussed earlier. If your institution does not have ultrasound technologists available 24/7, a TAU could also wait until morning.

If a cyst is found after detorsion, cystectomy is a reasonable approach if removing the cyst will not further damage the adnexa. Recall that torsions involving malignant adnexal masses are rare in pediatrics. So, if a cyst is found on laparoscopy, it is likely benign. Therefore, if the risk of adnexal damage is too high, cystectomy at the time of surgical detorsion is not necessary, and treatment can be deferred.

In cases of unprovoked torsion (i.e., normal adnexa), recurrent torsion, an absent contralateral ovary, or a congenitally long ovarian ligament, an oophoropexy could be performed. An oophoropexy is a procedure in which the ovary is fixed in the pelvis. The ovary can be fixed to the pelvic sidewall, the posterior wall of the uterus, or the uterosacral ligament. In theory, this change to the adnexal anatomy might decrease the likelihood of recurrence. Nevertheless, there is not enough evidence for this outcome. Furthermore, the effects of oophoropexy on fertility are uncertain. Given this, they are not currently recommended.

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Control of pain and nausea is an important part of management. In the ED, pain could be controlled with ketorolac—if the patient is not pregnant—morphine, or fentanyl. Nausea could be relieved with ondansetron. Post-op pain control could be achieved with detorsion itself, NSAIDs, and a short course of opioids.

Conclusion

Alright team, that concludes this PedsCases podcast on the approach to adnexal torsion in children and adolescents. Before we finish up, let's review the learning objectives.

1. **Define torsion.** Adnexal torsion is the partial or complete rotation of normal and/or abnormal structures of the uterine adnexa on their vascular pedicle.
2. **Review the anatomy and pathophysiology of torsion.** The relevant structures in torsion are the suspensory ligament of the ovary, the ovarian ligament, the broad ligament, and the ovarian artery. Also, remember that the ovary is suspended in the pelvis. The pathophysiology of torsion involves the adnexal structures twisting on their vascular pedicle leading to impaired blow flow, ischemia, infarction, and, ultimately, necrosis.
3. **List the most common clinical features of torsion and the two most critical diagnoses to rule out.** Torsion most commonly presents as sudden onset, severe, unilateral RLQ abdominal pain that is stabbing or sharp, intermittent, and non-radiating and tends to be associated with severe nausea, vomiting, and presyncope. However, remember that these features are nonspecific. The two most critical diagnoses to rule out are ectopic pregnancy and appendicitis.
4. **State the key test in the workup of torsion.** The key test in the workup of torsion is transabdominal ultrasonography.
5. **Discuss the recommended approach to the treatment of torsion.** The recommended treatment of torsion is prompt laparoscopic detorsion with or without concomitant cystectomy—not oophorectomy.

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References

1. American College of Obstetricians and Gynecologists' Committee on Adolescent Health Care, Abraham M, Keyser EA. Adnexal Torsion in Adolescents. Obstetrics & Gynecology [Internet]. 2019 Aug;134(2):e56–63. Available from: http://dx.doi.org/10.1097/AOG.0000000000003373
2. Kives S, Gascon S, Dubuc É, Van Eyk N. No. 341-Diagnosis and Management of Adnexal Torsion in Children, Adolescents, and Adults. Journal of Obstetrics and Gynaecology Canada [Internet]. 2017 Feb;39(2):82–90. Available from: http://dx.doi.org/10.1016/j.jogc.2016.10.001
3. Laufer, MR. Ovarian and fallopian tube torsion. In: Post TW, editor. UpToDate [Internet]. Waltham, MA: UpToDate; 2020. [cited 2020 Nov 19]. Available from: https://www.uptodate.com/contents/ovarian-and-fallopian-tube-torsion?search=ovarian%20torsion&source=search_result&selectedTitle=1~75&usage_type=default&display_rank=1
4. Drake RL, Vogl W, Mitchell AWM, Gray H, ClinicalKey Flex. Gray's Anatomy for Students [Internet]. 4th ed. Philadelphia, PA: Elsevier; 2020 [cited 2020 Nov 19].
5. Cydulka RK, Fitch MT, Joing SA, Wang VJ, Cline DM, Ma OJ. Tintinalli's Emergency Medicine Manual. 8th ed. New York, NY: McGraw-Hill Education; 2018.
6. Grunau GL, Harris A, Buckley J, Todd NJ. Diagnosis of Ovarian Torsion: Is It Time to Forget About Doppler? Journal of Obstetrics and Gynaecology Canada [Internet]. 2018 Jul;40(7):871–5. Available from: http://dx.doi.org/10.1016/j.jogc.2017.09.013

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