

Abdominal wall hernia and pregnancy: a systematic review

K. K. Jensen¹ · N. A. Henriksen¹ · L. N. Jorgensen¹

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Abstract

Purpose There is no consensus as to the treatment strategy for abdominal wall hernias in fertile women. This study was undertaken to review the current literature on treatment of abdominal wall hernias in fertile women before or during pregnancy.

Methods A literature search was undertaken in PubMed and Embase in combination with a cross-reference search of eligible papers.

Results We included 31 papers of which 23 were case reports. In fertile women undergoing sutured or mesh repair, pain was described in a few patients during the last trimester of a subsequent pregnancy. Emergency surgery of incarcerated hernias in pregnant women, as well as combined hernia repair and cesarean section appears as safe procedures. No major complications were reported following hernia repair before or during pregnancy. The combined procedure of elective cesarean section and abdominal wall hernia repair was reported in 102 patients without major complications.

Conclusions The literature on abdominal wall hernia and pregnancy is sparse. Abdominal wall hernia repair with suture or mesh may cause pain in the last trimester of a subsequent pregnancy. Hernia repair in conjunction with cesarean section appear as the optimal treatment of a pregnant patient with a symptomatic abdominal wall hernia.

Keywords Abdominal wall hernia · Hernia · Pregnancy · Mesh · Ventral hernia

✉ K. K. Jensen
mail@kristiankiim.dk

¹ Digestive Disease Center, Bispebjerg Hospital, University of Copenhagen, Bispebjerg Bakke 23, 2400 Copenhagen NV, Denmark

Introduction

Abdominal wall hernia repair is one of the most frequent surgical procedures [1]. Mesh implantation has reduced the number of recurrences significantly [2]. However, mesh-related problems such as wound complications, discomfort, pain and a potential loss of flexibility of the abdominal wall raise the question whether all patients should have mesh repair [3].

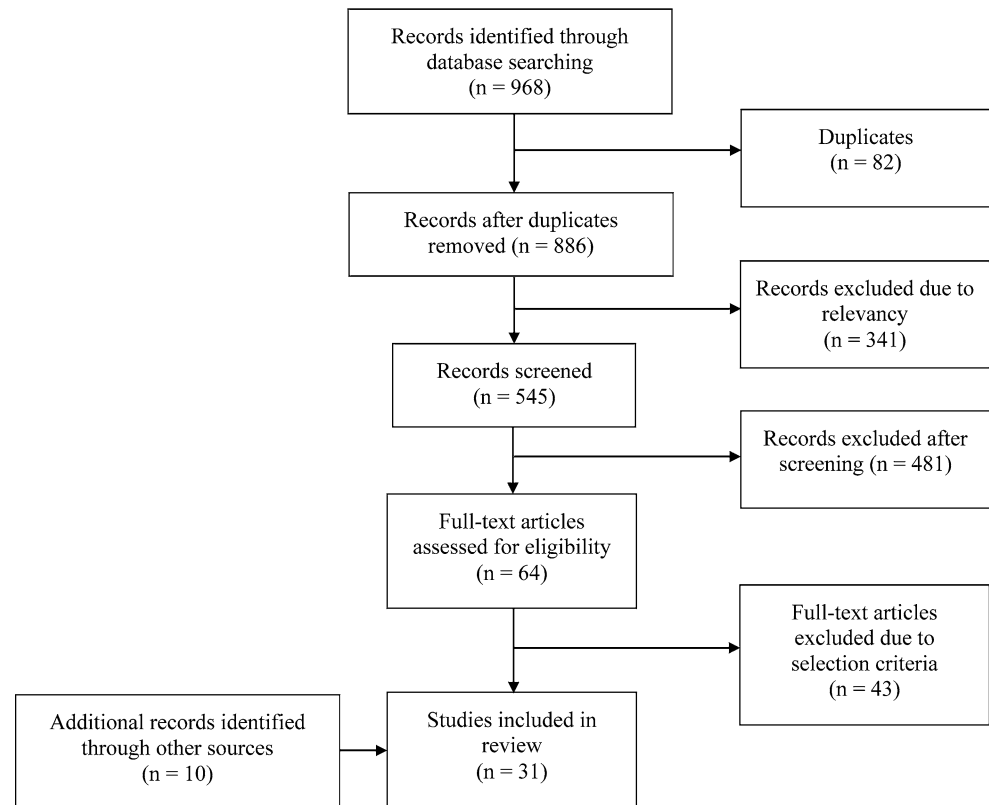
There is no consensus as to which treatment strategy to follow for symptomatic abdominal wall hernia in fertile women planning a future pregnancy. A watchful waiting strategy may cause a more painful hernia during pregnancy or even incarceration leading to emergency repair. If the hernia is repaired by suture alone, the risk of recurrence and symptoms during pregnancy is present. A hernia repair with mesh may restrict the flexibility of the abdominal wall [3], potentially causing pain during a subsequent pregnancy.

This study was undertaken to review the current literature describing the treatments of fertile women with abdominal wall hernias diagnosed before or during pregnancy.

Materials and methods

A literature search in the PubMed and Embase databases was conducted to identify relevant studies. The search terms {"hernia, ventral"(MeSH Terms) OR ["hernia"(All Fields) AND "ventral"(All Fields)] OR "ventral hernia"(All Fields) OR ["abdominal"(All Fields) AND "wall"(All Fields) AND "hernia"(All Fields)] OR "abdominal wall hernia"(All Fields)} AND ["pregnancy"(MeSH Terms) OR "pregnancy"(All Fields)] were

Fig. 1 Selection of articles for review



used. Abstracts were screened, and when assessed relevant, the entire article was read. Reference lists of relevant articles were reviewed in order to identify articles not included in the initial literature search. Criteria of relevance included English articles published between January 1984 and May 2013, describing treatment of abdominal wall hernia before, during or after pregnancy.

The primary literature search identified 968 papers of which 423 were excluded because they were duplicate publications or irrelevant. A total of 64 articles were selected for full read, of which a total of 21 articles were assessed relevant. In addition, 10 articles were identified through manual search of reference lists, leaving a total of 31 articles included in this review. The outcome of the literature search is demonstrated in a flowchart according to the PRISMA guidelines [4] (Fig. 1).

Results

Repair of abdominal wall hernia before pregnancy

A total of four articles describing abdominal wall hernia repair before pregnancy were identified describing mesh [5–7] and sutured repair [8] (Table 1). A polypropylene mesh was applied during open surgery for multiple abdominal wall hernias in one patient [5]. The size and

placement of the mesh or the type of hernias were not reported. The patient was treated for pain related to the mesh occurring during the second trimester and had recurrence of at least one hernia after giving birth.

Four patients gave birth after open hernia repair (two umbilical and two inguinal) [6]. A mesh was used in three of the cases, and the pregnancies were described as uncomplicated. No description of the placement of the mesh was given.

A recent study described pregnancies in eight women after laparoscopic mesh repair for ventral hernias (four incisional, two umbilical, and two epigastric) [7]. All patients underwent an IPOM technique with an expanded polytetrafluoroethylene mesh fixated by either double-crown tack technique or tacks combined with trans-abdominal sutures. Mesh-related pain during the third trimester was reported in five of the women. Six of the women had also given birth prior to the hernia repair, and all of them mentioned more pain in the abdominal wall during the pregnancy after the hernia repair. Vaginal delivery was completed in all except one where the indication for cesarean section was not related to the mesh. One patient had a clinical recurrence of an incisional hernia postpartum.

Sutured repair of a ventral hernia without mesh was described in 27 patients subsequently completing a pregnancy [8]. No recurrences were found during clinical

Table 1 Repair of abdominal wall hernia before pregnancy

References	N	Hernia type	Surgical intervention	Postoperative complication
Aaen [5]	1	Ventral	Mesh repair	Pain related to the mesh and recurrence
Buch [6]	4	Inguinal (2), umbilical (2)	Mesh (3), sutured repair (1)	None
Schoenmaeckers [7]	8	Incisional (4), umbilical (2), epigastric (2)	Mesh repair	Pain during the last trimester (5), recurrence (1)
Abrahamson [8]	27	Umbilical (20), incisional (6), umbilical (1)	Sutured repair	None

follow-up, but the paper lacked a description of the length of follow-up as well as information on possible complications during pregnancy or delivery secondary to the hernia repair.

In total, four studies reported on 40 patients completing pregnancies after repair of abdominal wall hernias. Pain related to the abdominal wall in the last trimester was described in 6 of the 12 patients treated with a mesh. Furthermore, two cases of recurrence were reported in the patients treated with mesh.

Repair of abdominal wall hernia during pregnancy

Twelve cases of abdominal wall hernia repair during pregnancy were identified (Table 2).

Sutured repair

Six case studies reported on emergency repair of umbilical hernias during pregnancy. In four of the cases, the hernia sac contained an incarcerated uterine fibroid [9–12]. Three of the women with this pathology presented with sudden onset of pain related to the hernia. All four underwent sutured repair of the hernia and no complications were encountered postoperatively. One-year follow-up was done in one study, reporting no recurrence [10]. Perry et al. [13] described a patient who did not undergo treatment for an

umbilical hernia until her third trimester, when the hernia incarcerated. The surgical technique for repair of the fascial defect and details on the outcome of the pregnancy were not described. Ahmed et al. reported spontaneous rupture of an umbilical hernia in a woman with a second trimester pregnancy. The patient, who underwent emergency laparotomy with small bowel resection and sutured hernia repair, completed vaginal delivery 6 weeks later and had an uncomplicated 9-month follow-up [14].

Two cases were reported of incarcerated Spigelian hernia diagnosed during the first and second trimester, respectively. In both cases, emergency suture herniorrhaphy was done, and the postoperative recovery was uneventful. No description of outcomes of the pregnancies was given [15, 16].

Open surgery with small bowel resection and presumably sutured repair was performed in one patient with inguinal hernia during the first semester. The patient aborted spontaneously 4 weeks later [17].

Mesh technique

Five case reports described mesh treatment for emergency repair of abdominal wall hernias during pregnancy. One patient had a second trimester pregnancy and underwent laparoscopic repair of an incarcerated umbilical hernia after presenting with 4 hours of pain. Laparoscopic

Table 2 Single cases of abdominal wall hernia repair during pregnancy

References	Type of hernia	Priority of surgery	Surgical intervention	Postoperative complication
Ehigiegba [9]	Umbilical	Emergency	Sutured repair	None
Uludag [10]	Umbilical	Emergency	Sutured repair	None
Seims [11]	Umbilical	Emergency	Sutured repair	Not described
Wong [12]	Umbilical	Emergency	Sutured repair	None
Perry [13]	Umbilical	Emergency	Sutured repair	Not described
Ahmed [14]	Umbilical	Emergency	Sutured repair and small bowel resection	None
Zalel [15]	Spigelian	Emergency	Sutured repair	None
Udare [16]	Spigelian	Emergency	Sutured repair	Not described
Limjoco [17]	Inguinal	Emergency	Sutured repair and small bowel resection	None
Wai [18]	Umbilical	Emergency	Mesh repair	None
Martin [19]	Incisional	Emergency	Mesh repair	Mesh protrusion after 6 months
Deka [20]	Incisional	Emergency	Mesh repair	Not described

exploration revealed herniated incarcerated omentum in an umbilical hernia, which was repaired by an IPOM fixated with tackers and transfascial sutures. The remaining pregnancy was uncomplicated and no mesh-related pain was reported [18]. A patient with a third trimester pregnancy was operated on for a perforated appendix through a transverse incision. She developed fascial dehiscence on postoperative day 6, and underwent repair with a 12 × 6 cm polypropylene mesh. Fourteen days after the mesh placement, the patient had emergency cesarean section due to fever. There were no signs of a new fascial defect or infection at the repair site. At 6-month follow-up, the mesh protruded through the skin, but no hernia was evident. The protruding part of the mesh was excised with subsequent healing of the wound [19]. A pregnant woman in the third trimester presented with uterine incarceration through an incisional hernia. She underwent emergency laparotomy with repositioning of the uterus to the abdominal cavity followed by hernia repair with an on-lay polypropylene mesh. No follow-up was described [20].

Repair of abdominal wall hernia in conjunction with elective cesarean section

Seven articles were identified describing elective cesarean section and hernia repair during the same procedure (Table 3).

Immediately after cesarean section, one patient with an inguinal hernia underwent sutured repair including suture fixation of the ileopubic tract to Cooper's ligament to prevent a subsequent femoral hernia [21]. At 6-week follow-up, no recurrence was noted. A series of patients undergoing inguinal ($n = 5$) or umbilical ($n = 3$) hernia repair in conjunction with cesarean section has been described [22]. The applied repair techniques were Shouldice for inguinal and Rives-Stoppa for umbilical hernia. These combined procedures were compared with standard elective cesarean sections showing that opiate use and length of hospital stay were not increased by a supplementary herniotomy procedure. One patient developed a wound complication, and no hernia recurrences or complaints were reported during a mean follow-up of 56 months. Comparable findings were reported in a series of combined cesarean section and Lichtenstein ($n = 19$) or umbilical ($n = 9$) hernia mesh repair [23]. In this study, the access to the inguinal hernia was achieved through a Pfannenstiel incision. This has not been described in any other included studies. There was no significant difference of hospital stay comparing these 28 patients with 100 matched controls, who only underwent cesarean section. No clinical recurrences were reported during the 1 year follow-up.

In a larger series, 48 patients undergoing combined cesarean section and umbilical hernia repair were compared

with 100 patients solely undergoing elective cesarean section [24]. Direct suture repair was used for fascial defects <3 cm ($n = 36$) and a mesh was applied for larger defects ($n = 12$). Operating time was longer and the need for analgesics was greater in the combined procedure group, whereas length of hospital stay did not differ from the group with a standard cesarean section. Wound complications occurred in six (13 %) of the patients, and one (2 %) patient developed hernia recurrence during the 22-month follow-up. The highest recurrence rate was found in the most recent study, where 4 of 14 patients undergoing sutured umbilical hernia repair had clinical and ultrasonographic recurrence at a median 3-year follow-up [25].

Two cases of uterine herniation through an incisional hernia were treated conservatively until elective cesarean section and concomitant hernia repair was done [26]. Both patients, who had their hernias diagnosed during the third trimester, did not experience complications related to the hernia or the repair within a 9- and 14-month follow-up, respectively. One patient presented with a herniated gravid uterus during the third trimester. She underwent incisional hernia repair including component separation and sutured repair of the fascia immediately after elective cesarean section [27]. One-year follow-up was without complications.

To summarize, seven studies were found describing 102 patients undergoing hernia repair concomitant to cesarean section. No major complications to the surgical procedure were encountered, although wound complications developed in up to 13 % of the patients in two studies. It was not described in any of the studies whether or not the women had hernia-related symptoms during their pregnancy.

Repair of abdominal wall hernia in conjunction with emergency cesarean section

Two patients presented late in the third trimester and during active labor. One of the patients had previously undergone sutured repair of an umbilical hernia. They underwent emergency cesarean section followed by immediate hernia repair due to uterine umbilical herniation (Table 3). The procedures included direct suture of the fascia defect after delivery and the postoperative recovery was uncomplicated [28, 29]. One patient presented in the third trimester with rupture of the skin and peritoneum by a protruding uterus with contractions through an incisional hernia. She underwent emergency cesarean section and sutured hernia repair without postoperative complications during a 6-week follow-up [30].

Young et al. described a patient with a third trimester pregnancy and incarceration of small bowel in an incisional hernia. She underwent emergency cesarean section and

Table 3 Repair of abdominal wall hernia in conjunction with cesarean section

Article	N	Type of hernia	Priority of surgery	Surgical intervention	Complication to hernia repair
Altchek [21]	1	Inguinal	Elective	CS and sutured repair	None
Ochsenbein-Kölble [22]	8	Inguinal (5), umbilical (3)	Elective	CS and hernia repair [Stoppa (3), Shouldice (2), not described (3)]	Delayed wound healing (1)
Gabriele [23]	28	Umbilical (19), inguinal (9)	Elective	CS and sutured or mesh repair	None
Ghnnam [24]	48	Umbilical	Elective	CS and sutured or mesh repair	Wound infection (6), pain (2), recurrence (1)
Steinemann [25]	14	Umbilical	Elective	CS and sutured repair	Recurrence (4)
Saha [26]	2	Incisional	Elective	CS and mesh repair (1), sutured repair (1)	None
Palazzo [27]	1	Incisional	Elective	CS, component separation and sutured repair	None
Mbuagaw [28]	1	Umbilical	Emergency	CS and sutured repair	None
Punguyire [29]	1	Umbilical	Emergency	CS and sutured repair	Not described
Sahu [30]	1	Incisional	Emergency	CS and sutured repair	Not described
Young [31]	1	Incisional	Emergency	CS and sutured repair	None
Banerjee [32]	1	Incisional	Emergency	CS and sutured repair	None
Agrawal [33]	1	Incisional	Emergency	CS and sutured repair	None
Rao [34]	1	Incisional	Emergency	CS and mesh repair	None
Malhotra [35]	1	Incisional	Emergency	CS and mesh repair	Wound breakdown

CS cesarean section

concurrent herniorrhaphy with direct sutured repair. Six-week follow-up was without complications [31].

In two cases, emergency cesarean section and concurrent sutured incisional hernia repair were performed [32, 33].

Two patients presented with ischemic skin ulcers due to protrusion of the pregnant uterus through an incisional hernia [34, 35]. A conservative approach was chosen until emergency intervention was necessary at the end of the third trimester, where cesarean section and polypropylene mesh repair were carried out. One of the patients developed postoperative wound rupture and mesh protrusion, but wound healing and mesh salvage were obtained after conservative treatment [35].

Discussion

Most articles in this review on the treatment of abdominal wall hernia before and during pregnancy, as well as in conjunction with cesarean section, were case reports or small case series. No randomized controlled trials were found, underlining the lack of research done in this field. Furthermore, most case stories stem from third-world countries where patients do not attend a physician regularly, and therefore present at a much later time than in the industrialized world. The lessons learned from these reports are therefore arguably limited. In general, no major

complications were reported in female patients during their pregnancy following previous abdominal wall hernia repair with mesh, except from a few cases of pain during the third trimester.

Fertile women who seek treatment for an abdominal wall hernia remain a challenge for the surgeon, since not much is known about the consequences of pregnancy after repair of the hernia. The main problem during pregnancy after hernia repair seems to be abdominal wall pain related to the mesh, primarily in the third trimester. Interestingly, six of eight patients in one study experienced stronger pain in the abdominal wall during pregnancy after hernia repair with mesh, than they did during a previous pregnancy before hernia repair [7], although it is not known whether the hernia was present at that time. It is thus hypothesized, that the insertion of a mesh may interrupt the elasticity of the abdominal wall and cause pain, as has also been described in a case report of a vaginal delivery after mesh repair of an omphalocele [36]. No description of abdominal wall pain during pregnancy after sutured hernia repair has been provided [8], though interesting, since it could help clarify whether it is the hernia repair itself or the insertion of a mesh that causes pain.

Pregnancy after mesh repair of an abdominal wall hernia seems safe and without an increased risk of hernia recurrence, although long-term follow-up is limited. As for pregnancy after sutured repair, no conclusions can be drawn based on the literature found, but the overall risk of

recurrence after suture repair in non-pregnant patients suggests that this approach should be avoided [37]. It is not possible to conclude whether pregnancy after hernia repair leads to increased recurrence rates or whether pregnant women with a previous mesh repair experience more pain than pregnant women with a hernia, since the symptoms related to an untreated hernia during pregnancy are unknown.

Not much is known about the development of abdominal wall hernias during pregnancy. It has been reported that the incidence of inguinal hernia during pregnancy is 1:1000–3000, and 75 % of these occur in multiparas [38], suggesting that the increased intraabdominal pressure combined with hormonal changes during pregnancy predisposes to inguinal hernia. On the other hand, Liem et al. [39] could not demonstrate that parturition increased the risk of inguinal hernia. Furthermore, weight gain and high body mass index, which are encountered during pregnancy, are not identified risk factors for inguinal hernia formation [40, 41]. It is not known how often an abdominal wall hernia becomes symptomatic during pregnancy. Hypothetically, the increased pressure on the abdominal wall may cause symptoms from an otherwise asymptomatic hernia, as has been described in a recent case report. A 30-week pregnant woman with a previously asymptomatic epigastric hernia presented with hernia incarceration that resolved spontaneously before surgical intervention was commenced [42]. From the limited number of reports included in this review, the risk of hernia incarceration and pain during pregnancy cannot be determined. Hernias have previously been estimated to account for under 5 % of the cases of bowel obstruction during pregnancy [43].

The indications for emergency hernia repair during pregnancy do not differ from those for non-pregnant patients. After exclusion of obstetrical pathology, pain related to an abdominal wall hernia without intestinal affection is not an absolute indication for surgery. The diagnosis of intestinal obstruction due to a strangulated hernia in a first trimester pregnant patient is challenging, because the prevalence of nausea and vomiting is high [44]. Radiological imaging can therefore be necessary, though computed tomography and X-ray modalities should preferentially be avoided [45]. Ultrasonography should be included in the diagnostic assessment of a pregnant woman with a bulge in the groin, as round ligament varicosities constitute a differential diagnosis to inguinal and femoral hernia [46, 47].

Abdominal wall hernia repair concomitant to cesarean section seems feasible and beneficial to the patient, as the current literature suggests no increased risk of severe peri- or postoperative complications. Moreover, a combined procedure saves the patient from an additional operative procedure. It is a concern that two studies reported a rather

high rate of postoperative wound complications, although comparable to that following standard elective cesarean section [48]. If this high rate of wound complications is confirmed in future studies, a more conservative approach to repair of asymptomatic hernias in conjunction to cesarean section should be considered. Due to the limited data in the included studies it was not possible to distinguish between complications after inguinal and ventral hernia repair concomitant to cesarean section. Conservative approach should perhaps also be taken when pregnant women experience mild symptoms from a previously asymptomatic ventral hernia. No studies have examined whether such patients continue to have symptoms from the hernia postpartum.

In case of planned inguinal hernia repair adjunct to cesarean section, the trauma on the abdominal wall is minimal when performing the Pfannenstiel incision that allows easy access to both the uterus and the hernia site. In case of a hernia in the infra-umbilical region, the incision of choice for cesarean section should be Pfannenstiel, due to the low risk of complications such as incisional hernia [49]. Ventral hernias in the lower abdomen may ideally be repaired through a Pfannenstiel access. Furthermore, repair of hernias with a large cranio-caudal fascial defect should be undertaken through cranio-caudal incision. The literature does not permit the recommendation of a specific procedure, as both inguinal and umbilical hernias were repaired by different techniques. One study reported a high recurrence rate after the combined procedure [25]. Whether this was due to a thorough follow-up that included ultrasonography, the avoidance of mesh usage or merely coincidence cannot be concluded. In case of groin hernias in women, it is generally advised to place a preperitoneal mesh due to the risk of overlooking a femoral hernia [50]. This approach should also be taken for repair of groin hernia concomitant to cesarean section.

Abdominal surgery during pregnancy is not novel. The two most common surgical non-obstetric procedures in pregnant women are appendectomy and cholecystectomy [51], both of which are feasible and safe by laparoscopic techniques [52–54]. Because general anesthesia itself does not pose a high risk of complications to the mother or the fetus [55], abdominal wall hernia repair during pregnancy should be possible with only minimal risks attached.

In conclusion, the specific strategy toward treatment of abdominal wall hernia in fertile women in relation to pregnancy is not very well described in the literature, and further studies with longer follow-up are needed. Pregnancy after abdominal wall hernia repair with either suture or mesh repair does not seem to increase the risk of obstetric complications. However, there are reports of increased abdominal wall pain during the last part of pregnancy after mesh repair. Hernia repair during

pregnancy appears safe, although surgery should be limited to emergency cases with incarceration. The combined procedure of cesarean section and hernia repair seems feasible and safe. This approach, that might be the optimal treatment for pregnant patients with minor abdominal wall hernias, should be examined in a randomized setting.

Conflict of interest KJ, NH and LJ declare no conflict of interest.

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