

Bladder Horn Appearance on Ultrasonographic Examination Prior to Cesarean Section: Does it Predict High Cranial Attachment of the Bladder?

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OBJECTIVE: To investigate the value of bladder horn appearance seen on ultrasonography performed prior to cesarean section in prediction of high cranial attachment of bladder.

STUDY DESIGN: The study was carried out in delivery unit of a teaching hospital. Two hundred pregnant women, 66 with and 134 without ultrasonographic appearance of bladder horn with at least one previous CS delivery beyond 37 weeks of gestation were enrolled in the study.

RESULTS: The rate of high cranial attachment of the bladder in patients with or without bladder horn appearance is 33.3% and 26.9%, respectively ($p=0.51$). There was no difference in the incidence of dense adhesions between uterus and bladder requiring sharp dissection to create a bladder flap between two groups (22.7% vs. 20.2%) ($p>0.05$).

CONCLUSION: Ultrasonographic appearance of horn shaped attachment of bladder base to the uterus does not predict the high attachment of bladder to the uterus.

Keywords: Cesarean section, Bladder, Adhesion

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Introduction

Cesarean section (CS) is the most common surgery performed in the United States. In 2009, 1.3 million births (32.3%) occurred by cesarean section.¹ Global increase in cesarean section rates over the past two decades has led to increase of repeated CS and its potential complications.² More frequent use of this operation has made the development of postcesarean adhesions a much more common occurrence, leading to a wide variety of complications including poor fetal outcomes secondary to delayed operative delivery, increased blood loss, bladder and bowel injury.^{3,4} Urologic injury is the most common injury at the time of either obstetric or gynecologic surgery and most frequently damaged organ is the bladder. Risk factors for bladder injury during CS include previous cesarean delivery, adhesions, emergent cesarean delivery, and CS performed at the time of the second stage of labor.⁵

Although the risk factors are determined, the severity of adhesions, either between uterus and bladder or other intraabdominal organs cannot be predicted prior to repeat surgeries. Walid et al. previously described a specific echographic sign – uterine peaking- that may suggest vesico-uterine adhesions prior to laparoscopic surgeries.⁶ In this study we aimed to investigate the value of ultrasonographic peak sign of the bladder -bladder horn appearance- in prediction of high cranial attachment of bladder to the uterus prior to CS.

Material and Method

The study was carried out in the delivery unit of a teaching hospital between April 2013 and September 2013. Pregnant women with at least one previous CS delivery beyond 37 weeks of gestation were enrolled in the study. Informed consent was obtained from all participants and the study was approved by the local ethics committee of the hospital.

All women were selected from patients who underwent repeat CS deliveries. Exclusion criteria were emergency repeat CS delivery, previous CS delivery with classic or T incision, midline skin incision, previous pelvic infection, previous laparotomy. The age, gravidity, parity, gestational week, body mass index (BMI) and prior CS delivery history were recorded. Ultrasonographic evaluation of lower uterine segment (LUS) and presence or absence of horn shaped attachment of bladder base to the uterus (Figure 1) was done before

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surgery. Transabdominal sonographic examination was carried out with a half-full urinary bladder to allow good imaging of the LUS. The lower part of the uterus was scanned sagittally to identify the area likely to contain the uterine scar. The ultrasound probe was then placed transversely to identify the thinnest zone of the LUS. The thickness of the LUS was measured by placing one caliper at the interface between urine and bladder wall and the other at the interface between amniotic fluid and decidua.^{7,8} All of the measurements were done by the same researcher (I.K.). Hospital records of the previous surgeries revealed that uterus was closed in single layer fashion and visceral or parietal peritoneum was not closed in all cases.

Both a resident and a senior obstetrician performed all the surgeries. Intra-abdominal location and density of adhesions, adhesions between LUS and the bladder were reported by the senior operator. Intra-abdominal adhesions were graded according to the modified Nair's classification. Absence of adhesions was categorized as grade 0, whereas adherence of the viscera to the anterior abdominal wall or to the uterus, or uterus to anterior abdominal wall and obliteration of the recto-vaginal pouch was categorized as grade 4. Grade 1 and 2 corresponded to filmy adhesions and grade 3 and 4 to dense adhesions.⁹ Attachment of the highest part of the bladder to the anterior wall of the uterus was graded according to the level of the uterine scar (under, over or above the scar) and the need for sharp dissection to create a bladder flap at the time of surgery was noted. At CS, a lower uterine segment transverse incision was performed. After delivery of the fetus, the incision was closed with one layer using 1.0 polyglycolic acid sutures in a non-interrupted fashion. Neither visceral nor parietal peritoneum was closed. The fascia was closed with 1.0-polyglycolic acid sutures and 3.0-polypropylene sutures were used for the closure of the skin in a subcuticular non-interrupted fashion. One gram of cefazolin was given to all patients during the operation after the cord was clamped.

All statistical analyses were performed using IBM SPSS version 17.0 (SPSS, Chicago, IL, USA). Continuous variables are presented as mean \pm standard de-

viation and compared using Student's independent samples t-test. Non-parametric variables were tested with the Mann-Whitney U-test. Fisher's exact test or χ^2 -test was used for the comparison of categorical values. Statistical significance was assumed with a probability error of $p < 0.05$.

Results

A total of 200 term pregnant women, 66 with ultrasonographic appearance of a bladder horn (Group I) and 134 without a bladder horn appearance (Group II) were enrolled in this study. No significant difference was found between the two groups regarding age, BMI, gestational week at delivery, number of previous CS deliveries, the duration since the last CS delivery or length and width of the previous skin incisions ($p > 0.05$) (Table 1). LUS is statistically significantly thicker in group II than in group I (5.4 ± 1.3 vs. 6.2 ± 1.7 mm). The rate of high cranial attachment of the bladder in patients with or without bladder horn appearance is 33.3% and 26.9%, respectively. The difference between two groups, although being very close, is not statistically significant ($p = 0.51$). There was no difference in the incidence of dense adhesions between uterus and bladder requiring sharp dissection to create a bladder flap between two groups (22.7% vs. 20.2%) ($p > 0.05$). With respect to intra-abdominal adhesions (no adhesion, filmy or dense), no significant difference found either ($p > 0.05$) (Table 1).

Table 1: Characteristics of the patients with or without ultrasonographic appearance of bladder peak

	With bladder peak appearance (n=66)	No bladder peak appearance (n=134)	p value
Age (years)	29.8 \pm 4.5	29.1 \pm 4.8	0.29
BMI (kg/m ²)	30.6 \pm 4.6	29.5 \pm 4.4	0.12
Gestational age (weeks)	39.2 \pm 0.5	39.2 \pm 0.4	0.24
Time passed from last surgery (years)	5.1 \pm 3.0	5.4 \pm 3.2	0.58
Number of previous cesarean section			
1	47 (71.2%)	107 (79.8%)	0.54
2	18 (27.3%)	25 (18.7%)	
≥ 3	1 (1.5%)	2 (1.5%)	
Width of the incision (mm)	3.4 \pm 0.9	3.5 \pm 1.1	0.69
Length of incision (cm)	15.1 \pm 1.6	15.2 \pm 1.8	0.14
Lower uterine segment thickness (mm)	5.4 \pm 1.3	6.2 \pm 1.7	0.002*
Attachment of bladder to the uterus			
Below the uterine scar	44 (66.7%)	98 (73.1%)	0.51
Over or above the uterine scar	22 (33.3%)	36 (26.9%)	
Dens adhesion between uterus and bladder			
Yes	15 (22.7%)	27 (20.2%)	0.58
No	51 (77.3%)	107 (79.8%)	
Intra-abdominal adhesion			
No adhesion	35 (53%)	65 (48.5%)	0.84
Filmy	14 (21.2%)	31 (23.1%)	
Dense	17 (25.8%)	38 (28.4%)	

BMI: Body mass index, *: Statistically significant.

The receiver-operator curve analysis for testing the significance of scar width for prediction of high attachment of the bladder to the anterior wall of the uterus showed an area under the curve of 0.60 ($P=0.023$, 95% confidence interval [CI]=0.52-0.68) (Figure 1). Scar width of 2.5 mm or greater had a sensitivity of 92% and specificity of 79%.



Figure 1: Horn shaped attachment of bladder base to the uterus, denoted as "peak".

Discussion

The presented study demonstrated that ultrasonographic appearance of horn shaped attachment of bladder base to the uterus does not predict the high attachment of bladder to the uterus (over or above the uterine scar) or the dense adhesions requiring sharp dissection while creating a bladder flap. LUS is found to be thinner in pregnant women with bladder horn appearance.

The pathogenesis of adhesion formation is a complex process in which fibrin, coagulation factors, and inflammatory cells contribute to repairing the damaged peritoneum.^{10,11} The incidence of adhesion formation is reported to be 55% to 100% after gynecologic surgeries, however rates of adhesion formation recorded at a second CS is lower and ranged from 24% to 46%, although they increase from 43% to 75% at the third, and up to 83% at the fourth CS.¹² Juntunen and colleagues compared intraperitoneal adhesions of patients having their 1st, 2nd, or 3rd CS with those undergoing their 4th to 10th CS and reported a significantly higher risk of adhesions in the latter group (OR, 8.1; CI, 2.7-23.8).¹³ More frequent use of CS during the last two decades has made the development of post-cesarean adhesions a much more common occurrence, leading to a wide variety of complications¹⁴ including poor fetal outcome secondary to delayed operative delivery, increased blood loss, bowel obstruction, and bladder injury.^{3,4} Eisenkop and colleagues reported that the incidence of bladder injury during repeat CS was 0.6%.¹⁶ Although surgical injuries to the bladder are infrequent during CS, surgeons need

to be aware of potential complications in order to appropriately counsel patients and also prepare themselves for possible intraoperative complications.¹² Adhesions are the most important source of bladder injury at the time of CS, secondary to a distortion of normal anatomy and difficulty in dissection. In the study of Phipps et al., adhesions were found to be present in 60% of the patients with bladder injuries compared to 10% of the controls during CS.³ The most common time for bladder injury to occur during CS was during the creation of the bladder flap (43%-60%) followed by during entry into the peritoneal cavity (30%-33%), and finally during the uterine incision or delivery (10%-24%).^{3,16} Bladder flap is created by first identifying the vesicouterine peritoneum and then making a horizontal incision just superior to this line to allow the surgeon to push the bladder caudally. Although it is believed that creating a flap prevent injury to the bladder at the time of delivery,¹⁷ it was shown that most of the injuries occurred while attempting to create a bladder flap.¹⁵ Moreover, it is sometimes hard to define the borders of vesicouterine peritoneum precisely, especially in emergent cases or patients with severe adhesions. Preoperative determination of the upper border of the bladder by ultrasonography may allow the surgeon to act more cautiously while creating the flap in high risk group. Although we hypothesized that ultrasonographic appearance of a bladder horn may be a sign of high cranial attachment of the bladder or presence of dense adhesions between LUS and bladder requiring sharp dissection which may be valuable in preoperative evaluation of at risk patients, we could not demonstrate a significant relation between these variables. Although being very close, no significant difference was detected between two groups regarding the level of the bladder attachment to the uterus. This could have reached a statistical significance had the sample size been larger, which is a limitation of this study. On the other hand, determination of this sign is subjective depending on the clinician performing ultrasonographic examination, which is the second limitation of this study.

The only significant difference between two groups was found to be in the thickness of LUS. LUS was found to be thinner in patients with bladder horn appearance in ultrasonographic examination. Myometrial thickness of the upper uterine segment remains fairly constant in the first and second trimesters of pregnancy, whereas a significant linear decrease is detected in thickness of the LUS with advancing gestational age.¹⁸ Stretching of the LUS with growing uterus may mechanically pull up the cranial part of the bladder, which will explain the horn appearance seen at bladder base.

In conclusion, although very low, bladder injury still represents a problem in patients with repeated cesarean sections. Preoperative determination of patients with high cranial attachment of bladder may allow the surgeons to prevent or be prepared for the possible complications during surgery while

creating a bladder flap and performing uterine incision. However bladder horn appearance on ultrasonographic examination does not seem to facilitate the determination of at risk population. Further studies are needed to draw strong conclusions.

Sezaryen Öncesi Yapılan Ultrasonografide Mesanede Boynuzsu Görünümün Saptanması Mesanenin Yukarı Çekilmesini Öngörebilir mi?

AMAÇ: Bu çalışmanın amacı, preoperatif ultrasonografik olarak saptanan mesanede boynuzsu görünümün mesanenin yukarı çekilmesini öngörmedeki yerini araştırmaktır.

GEREÇ VE YÖNTEM: Çalışma bir eğitim araştırma hastanesinin doğum servisinde yürütülmüş olup, çalışmaya 37 haftayı tamamlamış, en az bir geçirilmiş sezaryen ameliyatı olan, mesanede boynuzsu görünüm saptanan 66 ve saptanmayan 134, toplam 200 gebe dahil edilmiştir.

BULGULAR: Boynuzsu görünüm tespit edilen hastaların %33,3'ü ile tespit edilmeyen hastaların %26,9'unda mesanenin yukarı çekildiği görülmüştür ($p=0,51$). Mesane ve uterus arasında flep oluşturulması esnasında keskin diseksiyona ihtiyaç gösteren dens adezyonların varlığı açısından da her iki grup arasında fark bulunmamıştır (%22,7 vs. %20,2) ($p>0,05$).

SONUÇ: Ultrasonografik olarak saptanan mesane tabanının uterusu boynuz şeklinde yapışma görüntüsü, mesanenin yukarı çekilmesini predikte edememektedir.

Anahtar Kelimeler: Sezaryen, Mesane, Adezyon

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