The Accuracy of Transabdominal Ultrasonography in Assessing Cervical Length in Comparison to Vaginal Ultrasonography at Mid-Pregnancy

Thesis

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Omar Essam Muhammad Khater

Contents

List of Abbreviations

Abbrev.	Full term
ACOG	: American College of Obstetricians and Gynecologists
BMI	: Body mass index
DES	: Diethylstilbestrol
GAGs	: Glycomsaminolgycans
MRI	: magnetic resonance imaging
PPROM	: Preterm premature rupture of membranes
ROMs	: Rupture of membranes
SD	: Standard deviation
SOGC	: Society of Obstetricians and Gynecologists of Canada
SPSS	: Statistical Package for Social Sciences
TAUS	: Transabdominal ultrasonography
TVUS	: Transvaginal ultrasonography
US	: Ultrasonography

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Introduction

Preterm birth is associated with neonatal morbidity and mortality as well as substantial health care costs. Late marriages, advanced maternal age, assisted reproductive techniques, and multiple pregnancies have contributed to the rise of the preterm birth frequency ***(Hassan et al., 2011 and Lucovnik et al., 2011).***

Several tocolytic agents, antibiotics for infection prevention, steroid injections for fetal lung maturation, and improvements in neonatal intensive care have improved the prognosis of premature neonates ***(Moroz and Simhan, 2012).***

Despite advances in obstetric and neonatal care, the rate of preterm birth has increased over the decades. Improvements in our understanding of the pathophysiologic mechanisms of preterm labor have changed the focus of management of preterm birth from tocolysis to primary prevention. Prophylactic progesterone supplementation and cervical length assessment for women who have had previous preterm birth are considered effective methods for preventing recurrent preterm birth ***(Flood and Malone, 2012).***

Although cervical length screening for women without previous preterm birth cannot yet be universally mandated,

there is a risk associated with preterm birth even in women without previous preterm birth ***(Mateus, 2011).***

However, most women not only have inconvenience during transvaginal sonography but also pay additional costs. From the point of view of physicians, transvaginal sonography takes up valuable time, and the physicians must purchase transvaginal ultrasound equipment for their medical offices ***(Roh et al., 2013).***

In contrast, transabdominal sonography for pregnant women requires neither additional cost nor effort because it is used for routine antenatal checkups. It is well known that many confounding factors, including the maternal physical condition and fetal position, influence the practical use of transabdominal sonography for cervical length assessment. The aim of this study is to determine the reliability of transabdominal sonography by comparison with transvaginal sonography for cervical length measurement in midpregnancy in a general obstetric population. Furthermore, we also investigated the maternal and fetal situations in which transabdominal measurement is reliable ***(Roh et al., 2013).***

Aim of the Work

To determine the accuracy of transabdominal ultrasonography in assessment of cervical length during mid-pregnancy.

Research question

Is transabdominal ultrasonography is as accurate as transvaginal ultrasonography in assessment of cervical length during mid-pregnancy?

Research hypothesis

Transabdominal ultrasonography is as accurate as the transvaginal ultrasonography in assessing cervical length at midpregnancy.

Chapter (1): Cervix

Parts of the cervix:

The cervix is the lower, narrow portion of the uterus where it joins with the top end of the vagina. It is cylindrical or conical in shape and protrudes through the anterior vaginal wall. Approximately half of its length is visible with appropriate medical equipment, the remainder lies above the vagina beyond view (Fig.1) ***(Weschler et al., 2002).***

The adult, non-pregnant cervix is 2.5 cm long. It is narrower and more cylindrical than the corpus, is widest at its midlevel, and round in section. The upper end communicates with the uterine body via the internal os and the lower end opens into the vagina at the external os. In nulliparous women, the external os is usually a circular aperture, whereas after childbirth it is a transverse slit ***(Susan et al., 2005)***.

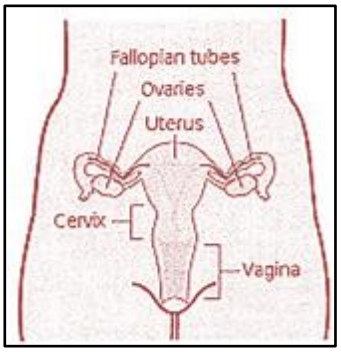

Figure (1): Schematic frontal view of female anatomy ***(Weschler et al., 2002).***

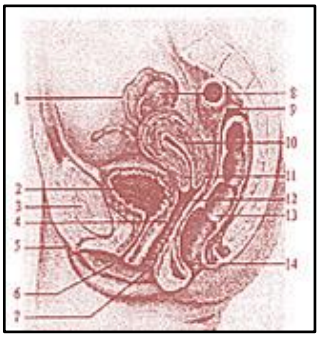

Figure (2): Fallopian tube, 2: Bladder, 3: Pubic bone, 4: G-spot, 5: Clitoris, 6: Urethra, 7: Vagina, 8: Ovary, 9: Sigmoid colon, 10: Uterus, 11: Fornix, 12: Cervix, 13: rectum, 14: Anus

Relations of the cervix:

The external end of the cervix bulges into the anterior wall of the vagina, which divides it into supravaginal and vaginal regions. The supravaginal part of the cervix is separated in front from the bladder by cellular connective tissue "the parametrium" which also passes to the sides of the cervix and laterally between the two layers of the broad ligaments ***(Susan et al., 2005)***.

The uterine arteries flank the cervix in this tissue and the ureters descend forward in it 2 cm from the cervix, curving under the arch formed by the uterine arteries ***(Susan et al., 2005)***.

The supravaginal part of the cervix is covered posteriorly by the peritoneum, which continues caudally onto the posterior vaginal wall and is then reflected onto the rectum via the rectouterine recess. Posteriorly, it is related to the rectum from which it may be separated by a terminal ileal coli. The vaginal part of the cervix projects into the vaginal cavity forming grooves around its perimeter termed vaginal fornices (Fig. 2) ***(Susan et al., 2005).***

Cervical ligaments:

Cardinal ligaments (Transverse cervical ligament) (Mackenrodt ligament):

It extends from the side of the cervix and lateral fornix of the vagina to attach extensively on the pelvic wall at the level of the cervix ***(Susan et al., 2005)***.

At the lateral margin of each broad ligament, the peritoneum is reflected onto the side of the pelvis. The thick base of the broad ligament is continuous with the connective tissue of the pelvic floor, the deepest portion is usually referred to as the cardinal ligament, and is composed of connective tissue that medially is united firmly to the supravaginal portion of the cervix ***(Cunningham et al., 2005)***.

Pubocervical ligament:

It passes forward from the anterior aspect of the supravaginal cervix to diverge around the urethra and attach to the posterior aspect of the pubic bone.

Utrosacral ligament:

It extends from an attachment posterolaterally to the supravaginal portion of the cervix to encircle the rectum and insert into the fascia over the sacrum. These ligaments are composed off connective tissue and some smooth muscles and are covered by peritoneum. They form the lateral boundaries of the pouch of Douglas ***(Cunningham et al., 2005)***.

Diameters of the cervix:

The normal diameter of the cervix in the nullipara is about 2.5 to 3 cm in length, 2 to 2.5 cm in its anteroposterior diameter and 2.5 to 3 cm in its lateral diameter. This difference is due to the shape of the cervical canal, which is straight in its sagittal plane and spindle shaped in the frontal plane. The wall of the cervix is about 1 cm thick throughout its length ***(Danforth, 1983)***.

Histology of the Cervix

Types of epithelium in the cervix:

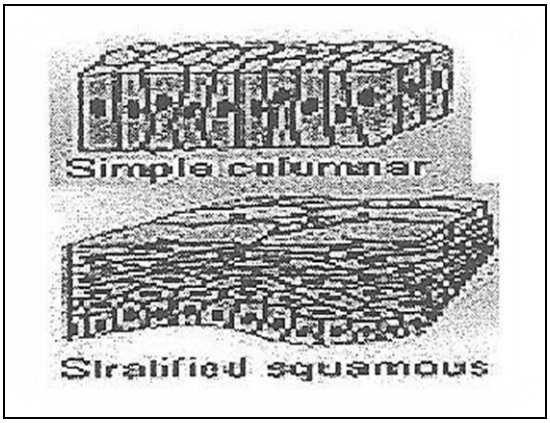

Figure (3): Simple columnar and stratified squamous epithelium. ***(Johanathan et al., 2002)***

The epithelium of the cervix is varied. The ectocervix is composed of non keratinized stratified squamous epithelium, the endocervix is composed of simple columnar epithelium. However, the intersection where these two epithelia meet (the squamocolumnar junction) is geographically variable and dependent on hormonal stimulation. It is the dynamic interface, this transformation zone is the most vulnerable to the development of squamous neoplasia (Fig. 3) ***(Johnanthan et al., 2002)***.

During the reproductive age, the epithelium is high and well differentiated. It consists of a basal cell layer with elongated nuclei perpendicular to the basal membrane, one or several layers of small parabasal cells, a broad intermediate

cell zone with abundant cytoplasmic glycogen, and a covering layer of narrow superficial cells ***(Gisela Dallenbach et al., 2006)***.

The mucosa of the cervical canal is composed of a single layer of a very highly ciliated columnar epithelium that rests on a thin basement membrane. Numerous cervical glands extend from the surface of the endocervical mucosa directly into the subjacent connective tissue. These glands furnish the thick cervical secretion ***(Cunningham et al., 2005)***.

Cervical Connective Tissue:

The extracellular matrix is made up of collagen fibers and elastin separated by tissue elasticity.

The Cervical Stroma:

The underlying cervical stroma is composed mainly of fibrous connective tissue, which is demonstrated by contrast stain to be almost entirely collagen. 50% of the total weight of the cervix is formed of collagen fibers. Collagen fibers of the cervix represent 82% of total cervical proteins ***(Danforth, 1983)***.

The non-pregnant cervix contains collagen fibers that have a definite cable-like structure and form fibril bundles. These fibrils appear wavy when viewed with a light microscope. During pregnancy, the uterine cervix rearranges its collagen fibers ***(Phyllis and Leppert, 1995)***. The basic