

X-ray Pelvimetry in Clinical Obstetrics

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X-ray pelvimetry has been used in obstetrics for over 80 years, but its clinical usefulness remains uncertain. Review of 101 consecutive x-ray pelvimetries obtained by Brown's modification of the Colcher-Sussman technique demonstrated the anteroposterior measurements to be of no value in predicting the eventual method of delivery. However, a transverse of the inlet of less than 13.0 cm and a transverse of the midpelvis of less than 10.0 cm were each associated with an increased frequency of operative delivery. In 94 cases no new information was obtained by x-ray pelvimetry; in the other 7 patients the information obtained was equally accessible by either ultrasonography or abdominal scout film. The authors conclude that x-ray pelvimetry by the technique used in their institution has very limited usefulness in clinical obstetrics.

Informed clinical decision-making requires synthesizing information obtained from appropriate diagnostic procedures with information obtained from a careful history and physical examination. With increasing concern for errors of commission as well as those of omission, the risks and benefits of diagnostic procedures—including established procedures—must be carefully evaluated. A useful diagnostic procedure must provide valuable information for diagnosis and management; this information must be unobtainable by other means. This paper appraises the present value of x-ray pelvimetry in clinical obstetrics.

Materials and Methods

A retrospective investigation was conducted at the University of Iowa Hospitals of 101 consecutive patients who underwent x-ray pelvimetry between July 1, 1977, and September 30, 1977. X-ray pelvimetry was performed on 12.6% of laboring patients during the study period. All patients were white. The radiographic technique used was Brown's modification of

the Colcher-Sussman technique.¹ All studies were interpreted by resident and faculty physicians of the Department of Obstetrics and Gynecology.

In analyzing each case attention was paid to the indications for x-ray pelvimetry, the course of labor before pelvimetry, the presentation as diagnosed before pelvimetry, the plan of management before and after pelvimetry, and the specific radiographic measurements. The course of labor after pelvimetry was reviewed; data included duration of labor, use of oxytocin, additional information gained from pelvimetry, and type of delivery.

Results

Eighty-five of the 101 patients were primigravidas and 10 were secundigravidas. Five of the remaining 6 multigravid women had pelvimetry performed because of breech presentation, and in the sixth patient it was performed because of uncertain fetal presentation. Infant weights were similar to established birth weight distributions for the University of Iowa Hospitals.² Indications for x-ray pelvimetry are noted in Table 1. In 3 cases the clinical diagnosis of presentation was incorrect. Except in 1 case in which a hyperextended fetal head was encountered in a known breech presentation, pelvimetry did not prevent a trial of labor.

The mean pelvic measurements for both the total population and subgroups are presented in Table 2 according to method of delivery. The only subgroup with pelvic measurements significantly different from the total group was that of patients who underwent midforceps delivery. In that group the transverse measurements of both inlet and midpelvis were significantly smaller than those of the total population. Patients undergoing cesarean section with a vertex presentation had smaller transverse inlet measurements, but the difference was not significant.

Analysis of the specific pelvimetry parameters (Figures 1 and 2) showed that anteroposterior (AP) measurements had no prognostic significance. No change

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Table 1. Indications for and Outcome of X-ray Pelvimetry

Indications	N	Method of delivery				
		Spontaneous	Low forceps	Mid forceps	Cesarean section	Vaginal breech
Secondary arrest of labor	59	23	13	6	16	1*
Breech presentation	21	2*			7†	12
Induction of labor	14	7	2	3	2	
Clinically small pelvis	4	3			1	
Unknown presentation	3	1			2	

* Clinical diagnosis of presentation incorrect.

† One patient with hyperextended fetal head on abdominal scout film.

Table 2. Pelvic Measurements (cm) (Mean ± SD)

Delivery	T inlet	AP inlet	T midpelvis	AP midpelvis
Total group	13.1 ± 1.0	12.2 ± 1.2	10.2 ± 0.8	12.2 ± 1.3
Spontaneous, low forceps	13.2 ± 1.0	12.1 ± 1.1	10.5 ± 0.8	12.2 ± 1.1
Midforceps	12.5 ± 0.9*	12.8 ± 1.2	9.8 ± 0.8*	12.7 ± 0.9
Cesarean section				
Vertex	12.8 ± 0.7	12.0 ± 0.8	10.2 ± 0.7	12.0 ± 1.0
Breech	13.5 ± 0.8	12.6 ± 1.2	10.8 ± 0.6	12.9 ± 1.2
Vaginal breech	13.2 ± 0.8	12.2 ± 1.2	10.4 ± 0.7	12.2 ± 1.4

T = transverse; AP = anteroposterior.

* Significantly different from total group, $P < .05$. All others not significant.

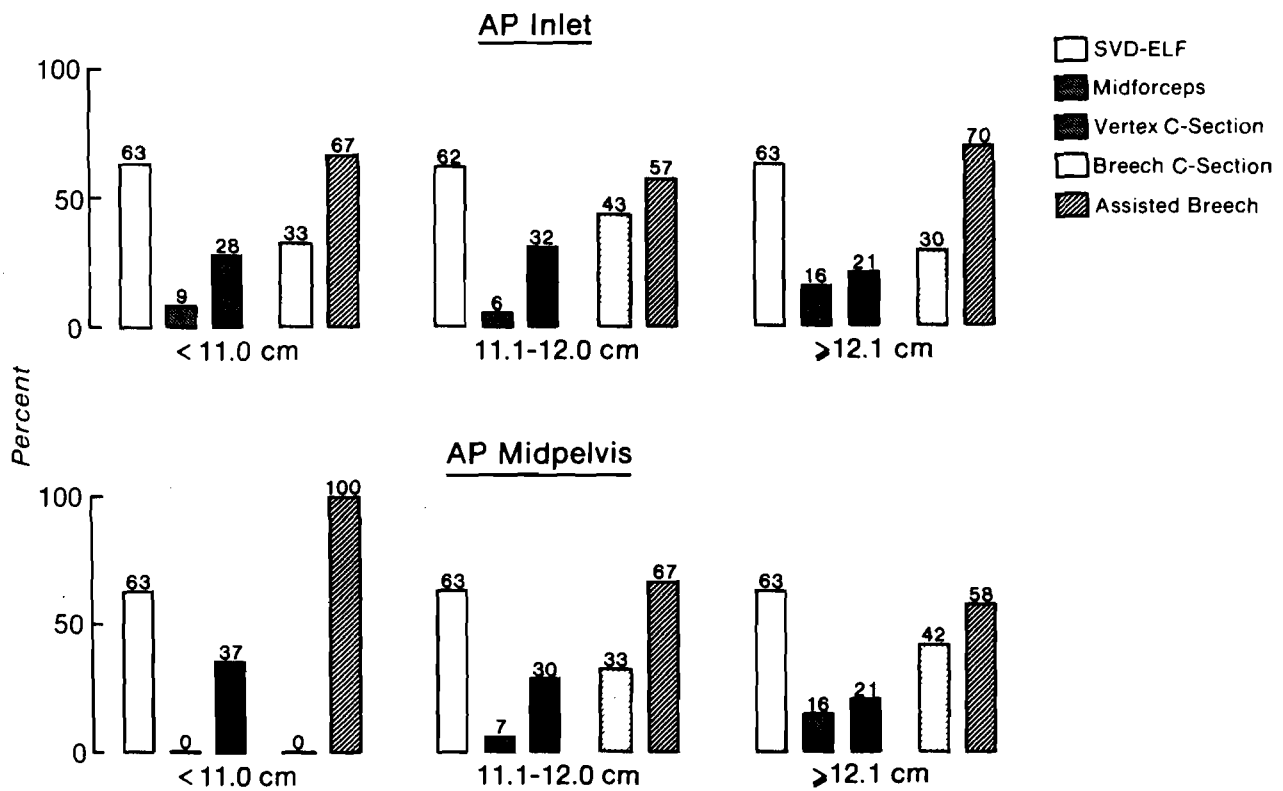


Figure 1. AP pelvimetry measurements compared by method of delivery. Numbers are the percentage of vertex or breech presentations by method of delivery in each measurement category.

Table 3. Mengert Indices (Mean \pm SD)*

Delivery	Inlet	Midpelvis
Total group	159 \pm 18	128 \pm 16
Spontaneous, low forceps	159 \pm 17	128 \pm 14
Midforceps	157 \pm 16	121 \pm 13
Cesarean section		
Vertex	154 \pm 15	124 \pm 16
Breech	172 \pm 31	143 \pm 26
Vaginal breech	158 \pm 20	128 \pm 12

* No statistically significant differences.

in the percentage of operative deliveries was observed among vertex presentations with decreasing AP measurements in either the inlet or midpelvis. However, there was a progressive increase in spontaneous vaginal delivery as transverse inlet and midpelvis measurements increased.

When the total population was compared against both the Mengert indices (Table 3) and the Colcher-Sussman indices (Table 4), no statistically significant differences between groups were observed. Even though the studies by Mengert and Colcher and Sussman involved radiographic examination of normal obstetric patients,^{3,4} the current data revealed larger mean values in all diameters than did those earlier studies.

The use of oxytocin for induction or stimulation of labor after x-ray pelvimetry was also reviewed (Table 5). No patient with breech presentation received oxytocin, but 54 of 81 patients with vertex presentation were stimulated with oxytocin. Twenty of 21 patients with vertex presentation who were eventually delivered by cesarean section received oxytocin stimulation after pelvimetry; the remaining patient had received oxytocin stimulation before pelvimetry, and the cesarean section was performed shortly after completion of the radiographic study. Of the patients who received oxytocin stimulation after secondary arrest of labor, those who underwent an operative delivery generally had longer labors (\bar{x} = 9.2 hours) than those who subsequently had spontaneous or outlet forceps delivery (\bar{x} = 7.4 hours). In addition, the average weight of infants delivered operatively was 3630 g, as compared with an average of 3110 g for those infants who subsequently were delivered spontaneously.

The cesarean section rate in the pelvimetry group was 28%—the overall cesarean section rate at this institution is 10.9%. With the exception of the case with a hyperextended head found in a breech presentation, all cesarean sections were performed after a trial of labor failed. No cesarean sections were performed for fetal distress in this study group.

In 94% of patients undergoing x-ray pelvimetry no

Table 4. Colcher-Sussman Indices (Mean \pm SD)*

Delivery	Inlet	Midpelvis
Total group	25.0 \pm 1.7	22.8 \pm 1.4
Spontaneous, low forceps	25.2 \pm 1.4	22.8 \pm 1.3
Midforceps	25.1 \pm 1.3	22.3 \pm 1.2
Cesarean section		
Vertex	24.8 \pm 1.2	22.3 \pm 1.4
Breech	26.2 \pm 2.0	24.0 \pm 2.2
Vaginal breech	25.5 \pm 1.4	22.7 \pm 1.3

* No statistically significant differences.

additional information was obtained for formulating a prospective labor management plan. In 7 patients the clinical diagnosis of presentation was found to be incorrect, an unknown presentation was diagnosed, or a known breech presentation was found to have a hyperextended head. In none of these 7 patients was this information related to maternal pelvic architecture.

Discussion

Although x-ray pelvimetry has been performed for over 80 years, the risks and benefits of the procedure have been questioned in recent years. The minimum amount of radiation to which the fetus is exposed is approximately 1.1 rads,³ but repeating films may increase this total to as much as 4 rads. The pioneering work of Stewart et al^{5,6} showed an increased incidence of childhood malignancies in those children exposed to radiation in utero. Subsequent studies have confirmed these findings,⁷ although criticism has justifiably been raised regarding the high degree of selectivity in these studies.⁸ Certainly, this questionable long-term risk might be acceptable if x-ray pelvimetry is effective in preventing serious and permanent metabolic or mechanical birth trauma. However, in none of the patients in this study was management altered by radiographically determined measurements of pelvic architecture.

The 28% cesarean section incidence is similar to that of previously reported pelvimetry studies.^{9,10} In those patients who were delivered abdominally on the basis of fetopelvic disproportion, x-ray pelvimetry did not

Table 5. Use of Oxytocin After Pelvimetry in Vertex Presentation

Delivery	No.	Percent
Overall	54/81	67
Spontaneous, low forceps	27/51	53
Midforceps	7/9	78
Cesarean section	20/21	95

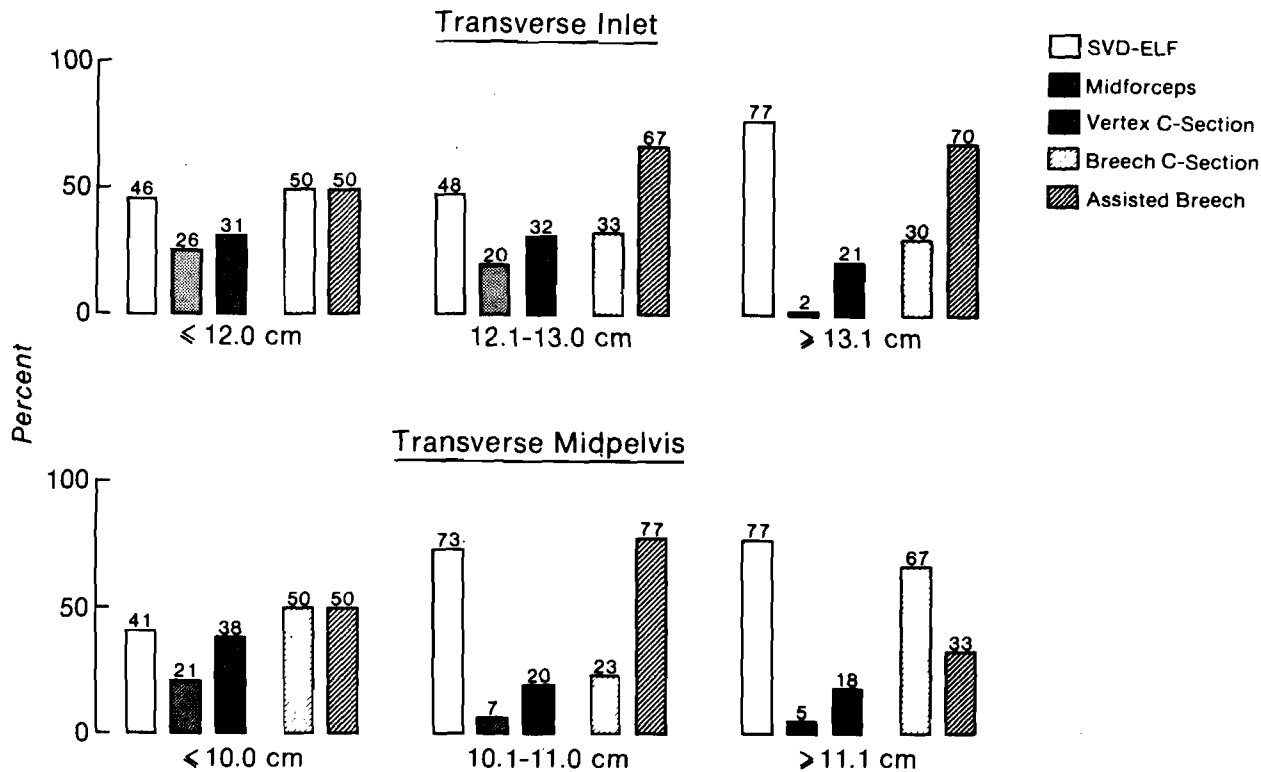


Figure 2. Transverse pelvimetry measurements compared by method of delivery. Numbers are the percentage of vertex or breech presentations by method of delivery in each measurement category.

shorten the duration of labor; this finding was also reported by Kelly et al.¹¹ In addition, even though those patients with a vertex presentation who eventually underwent operative delivery had a smaller pelvis in the transverse diameter, this information was not usable in the prospective management of labor as evidenced by the almost universal administration of oxytocin after arrest of labor, as well as by the increased duration of oxytocin administration before eventual operative delivery.

There are no significant differences in the pelvic measurements between those patients with breech and those with vertex presentations. In addition, the pelvis was largest, both by individual and combination indices, in those patients with breech presentations who were eventually delivered abdominally. This confirmed that patients with breech presentations who fail to progress in labor are delivered abdominally without augmentation regardless of pelvic measurements. Although the only prospectively significant finding in this breech population was not related to actual maternal bone architecture, the efficacy of x-ray pelvimetry for breech presentation is still controversial and the authors are not prepared to abandon the procedure in the presence of this indication.

However, in vertex presentations little useful information for the prospective management of labor was

obtained from pelvic measurements. Although the frequency of operative delivery increased in vertex presentations with smaller transverse measurements, this information was not used prospectively. AP measurements of the maternal pelvis were of no prognostic value in any circumstance. In this study the clinically useful information that was obtained could have been derived from either ultrasound examination or abdominal scout films with less expense and less radiation exposure. Certainly, whereas every patient deserves appropriate individualization of diagnostic procedures, in the authors' experience x-ray pelvimetry with vertex presentation provides little clinically useful information.

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