AMNIOTIC FLUID ASSESSMENT

INTRODUCTION

The primary source of amniotic fluid in the second and third trimester of pregnancy is fetal urine. The source of amniotic fluid in the first trimester of pregnancy however, is still poorly understood. Studies using dye installation tests in the amniotic cavity have shown that amniotic fluid volume increase throughout gestation until about 39-40 weeks (1, 2).

Assessment of amniotic fluid volume is an essential part of the basic obstetric ultrasound examination. The two techniques that are most commonly proposed for the estimation of amniotic fluid include assessment of the single maximal vertical pocket of fluid or the amniotic fluid index. The single maximal vertical pocket (MVP) technique involves finding the single largest pocket of amniotic fluid on ultrasound, free of cord and fetal parts, and then measuring the greatest vertical dimension with the ultrasound transducer perpendicular to the floor (**Figures 9.1** and **9.2**). The amniotic fluid index (AFI) technique is based on the division of the uterus into 4 equal quadrants and measuring the deepest vertical pocket of fluid in each quadrant (same technique as for MVP) and then adding the four measurements together (**Figure 9.3**) (3, 4). Most sonologists and sonographers measure the MVP and AFI in amniotic fluid pockets that are at least 1 cm in width and free of cord and fetal parts.

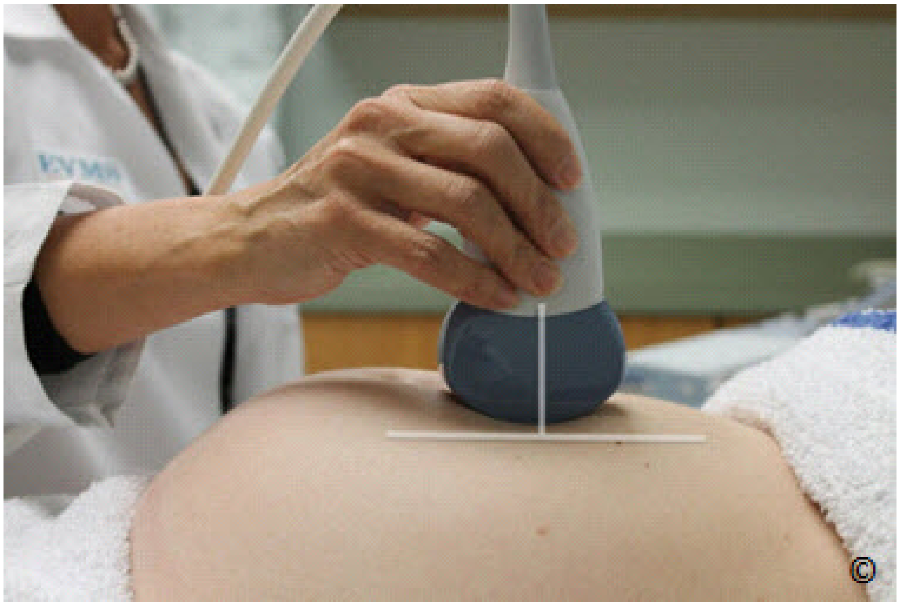

Figure 9.1: Transducer orientation for the measurement of amniotic fluid. Note that the transducer is in sagittal orientation on the maternal abdomen and is maintained perpendicular to the floor while scanning.

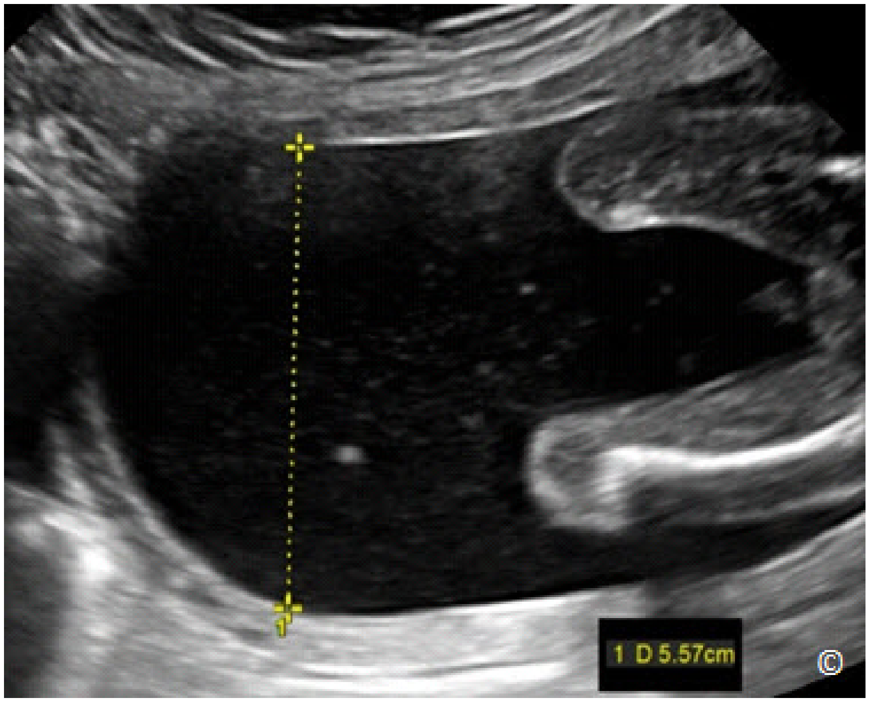

Figure 9.2: Maximal vertical pocket measurement of amniotic fluid. The quadrant in the uterus with most amniotic fluid is chosen and the deepest portion of that pocket is measured in a vertical line measurement (normal here at 5.5 cm). Note that the pocket is free of cord and fetal parts and is at least 1 cm in width.

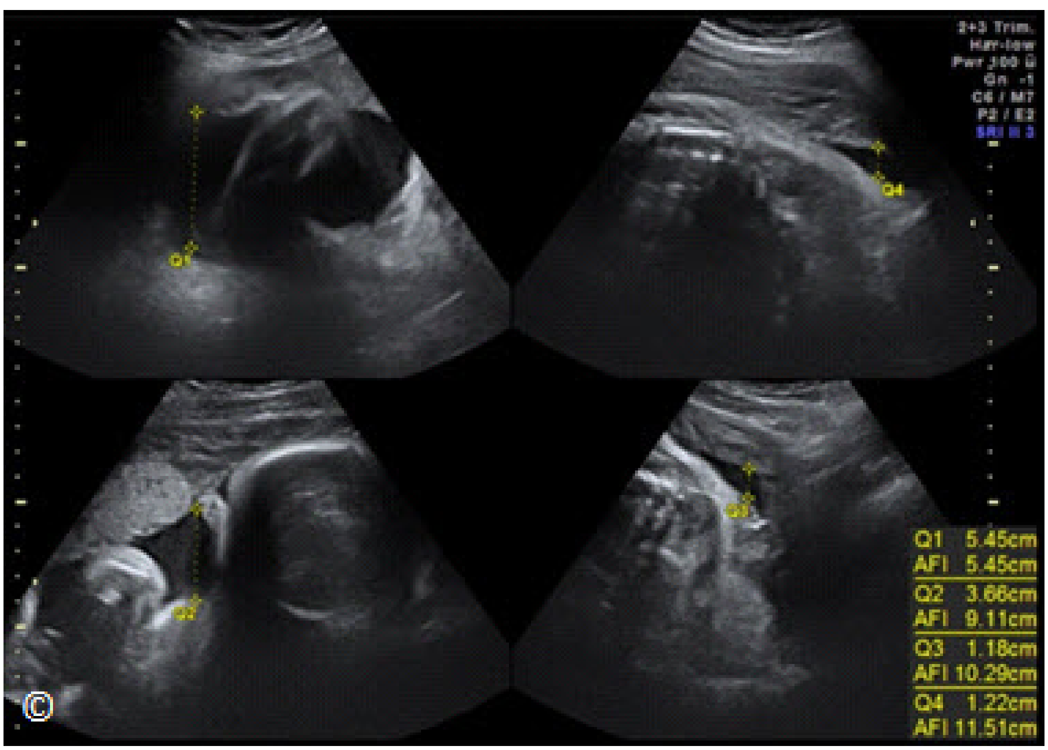

Figure 9.3: Measurement of amniotic fluid using the Amniotic Fluid Index (AFI) technique in a pregnancy with normal fluid. Note the measurements in four quadrants (Q) of the uterine cavity. AFI is determined by adding the four-quadrant measurements (normal range at 11.5 cm). See text for details.

OLIGOHYDRAMNIOS

The term oligohydramnios refers to decreased amniotic fluid volume relative to gestational age. **Table 9.1** lists the common causes of oligohydramnios. Oligohydramnios is described by a MVP of less than 2 cm (**Figure 9.4**), or an AFI of less than 5 cm. When no measurable pocket of amniotic fluid is noted in the uterine cavity, the term anhydramnios is used (**Figure 9.5**). Oligohydramnios has been linked to increased perinatal morbidity and mortality (5, 6). A corresponding corrected perinatal mortality rates of 109.4/1000, 37.74/1000 and 1.97/1000 were reported for MVP of < 1 cm, MVP between 1 - 2 cm, and MVP > 2 cm and < 8 cm respectively (6).

TABLE 9.1	Common Causes of Oligohydramnios
	- Premature rupture of membranes - Genitourinary abnormalities - Uteroplacental insufficiency - Postdates pregnancies

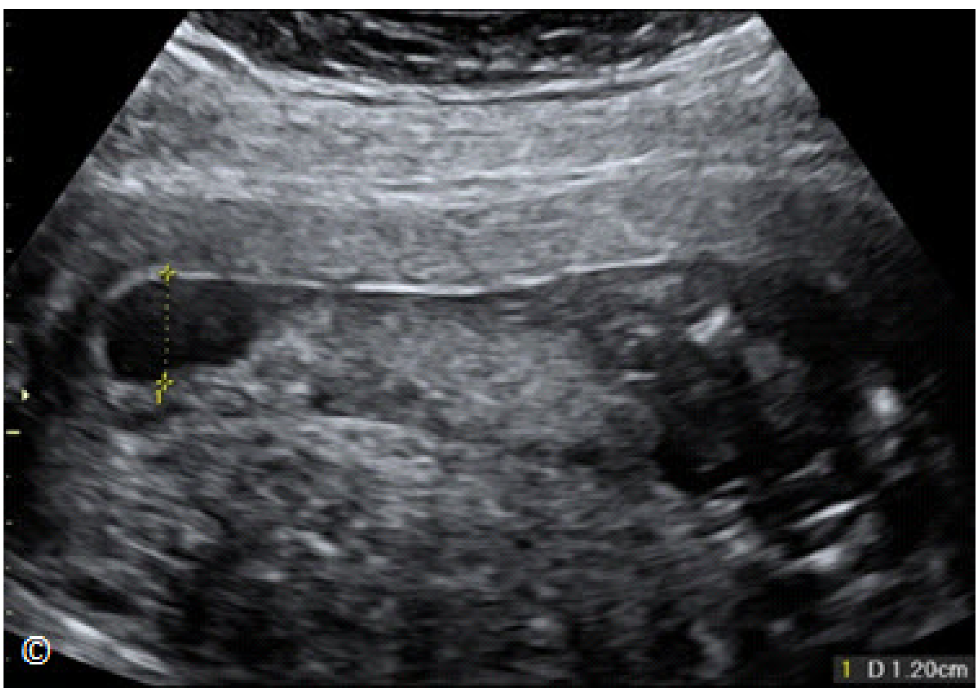

Figure 9.4: Oligohydramnios diagnosed by the Maximal Vertical Pocket (MVP) method. Note that the MVP measured 1.2 cm in this pregnancy.

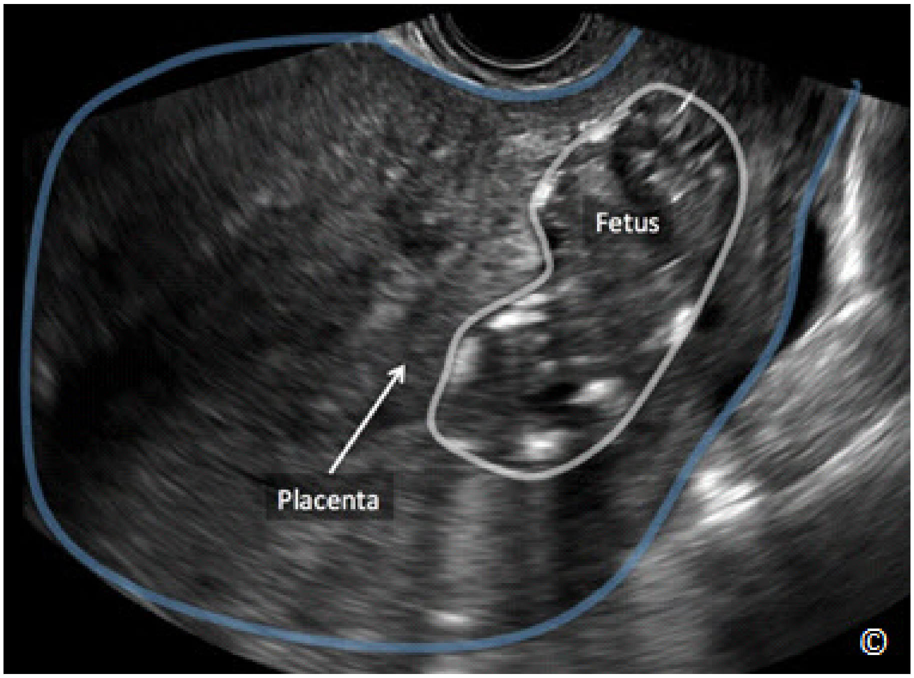

Figure 9.5: Anhydramnios in a fetus with bilateral renal agenesis. Note the total absence of amniotic fluid resulting in suboptimal ultrasound visualization. The white line is drawn around the fetus and the blue line is drawn around the uterus. The placenta is labeled.

The two described methods for the diagnosis of oligohydramnios, namely the MVP and AFI were compared in a Cochrane review (7). Five randomized trials with over 3000 pregnancies were analyzed. The AFI cut-off of oligohydramnios of < 5 cm was associated with more cases of diagnosed oligohydramnios (RR = 2.39), more induction of labor (RR = 1.92) and more emergent cesarean deliveries (RR = 1.46), with no effect on perinatal morbidity, including admission to the neonatal intensive care unit (7). Furthermore, assisted vaginal deliveries and the overall rate of cesarean deliveries were not different whether MVP or AFI was used (7). Given an increased in pregnancy intervention with no demonstrable perinatal benefit when oligohydramnios is defined by the AFI < 5 cm method, the authors of the Cochrane review and others have suggested that the MVP method is preferred over the AFI for amniotic fluid assessment in fetal surveillance (7, 8).

POLYHYDRAMNIOS

The term polyhydramnios refers to increased amniotic fluid volume relative to gestational age. **Table 9.2** lists the common causes of polyhydramnios. Polyhydramnios is defined by a MVP of equal to or greater than 8 cm (**Figure 9.6**), or an AFI equal to or greater than 24 cm (**Figure 9.7**). Idiopathic polyhydramnios, which occurs in 50 – 60 % of cases of polyhydramnios, has been linked to fetal macrosomia and an increase in adverse pregnancy outcome (9). Polyhydramnios has also been associated with increased perinatal morbidity and mortality (10, 11).

TABLE 9.2	Common Causes of Polyhydramnios

- Gestational and pregestational diabetes
- Isoimmunization
- Fetal structural and chromosomal abnormalities
- Fetal infections
- Multiple pregnancies with Twin-Twin Transfusion Syndrome
- Idiopathic

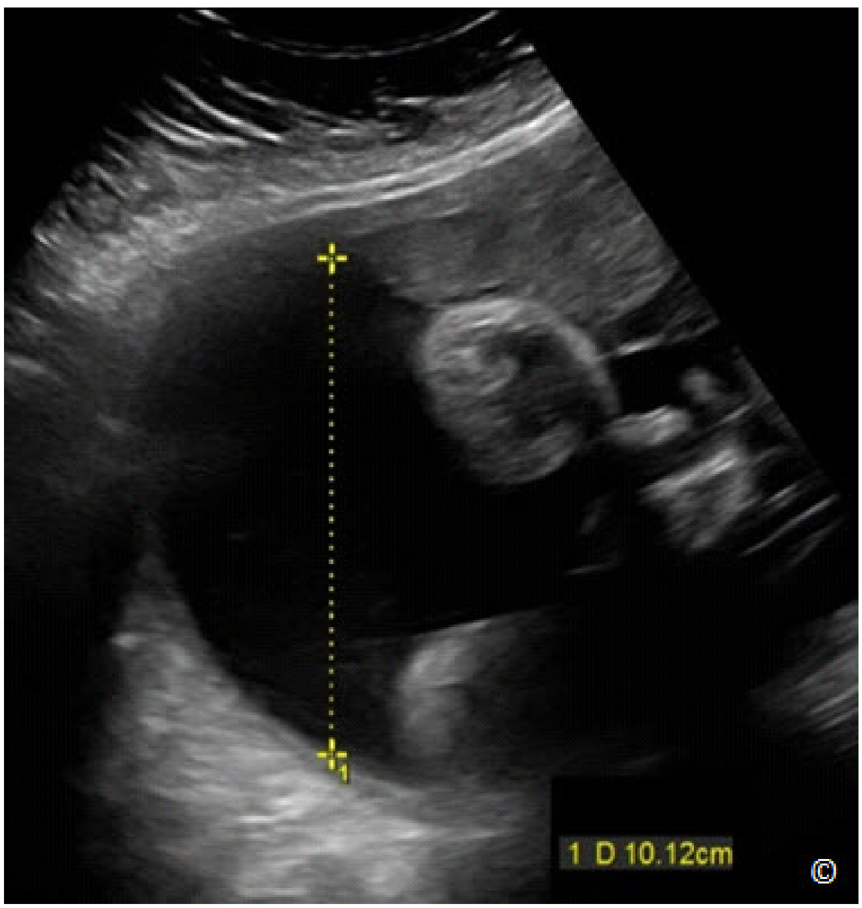

Figure 9.6: Polyhydramnios diagnosed by the Maximal Vertical Pocket (MVP) method. Note that the MVP measured 10.1 cm in this pregnancy.

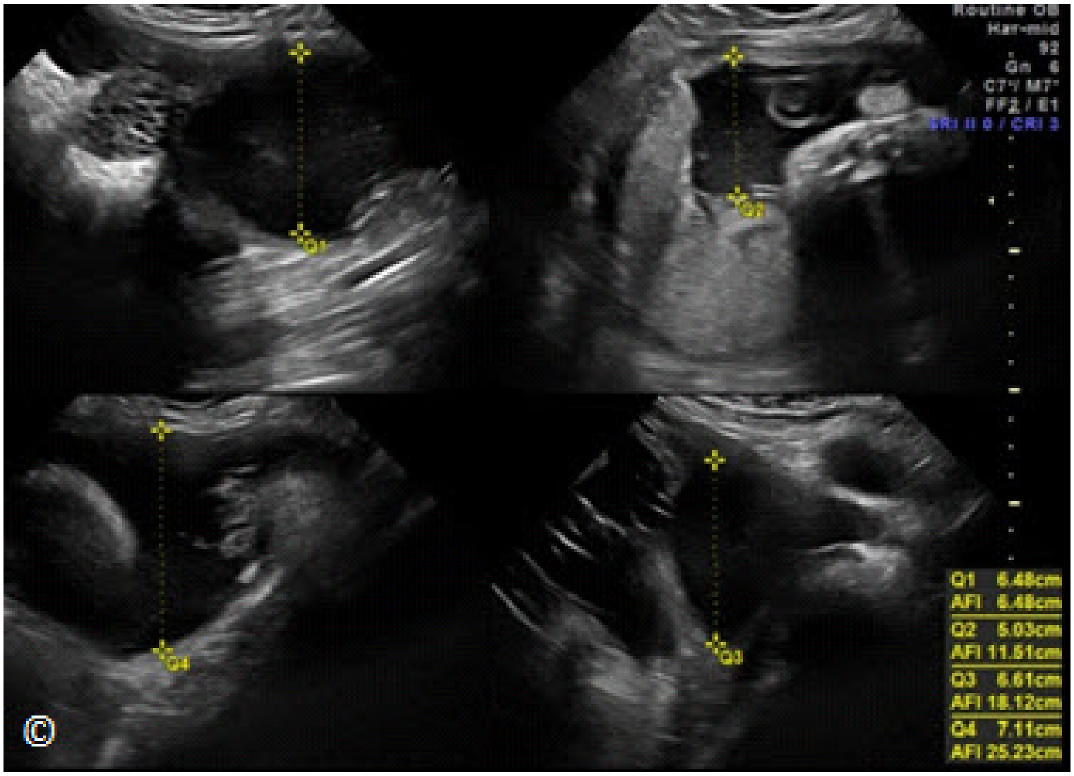

Figure 9.7: Polyhydramnios diagnosed by the Amniotic Fluid Index (AFI) method. Note that the AFI measured 25.2 cm in this pregnancy.

Given its simplicity, the authors recommend the MVP method for assessment of amniotic fluid. The choice of MVP for amniotic fluid assessment was also supported by a recent multi-society fetal imaging consensus workshop (12).

ULTRASOUND ESTIMATION OF AMNIOTIC VOLUME IN TWIN GESTATIONS

Both the MVP and AFI have been used to assess amniotic fluid volume in twin gestations (13). The AFI requires an understanding of the spatial relationship of the gestational sacs in order to allow for each twin's amniotic compartment to be divided into four quadrants. Given the technical difficulty involved in this process, especially in the third trimester when fetal crowding is common, the authors recommend the use of MVP of each twin's amniotic fluid compartment to assess the fluid volume (**Figure 9.8**). The MVP in the amniotic sac of each twin appears to remain relatively stable between 17 and 37 weeks' gestation, with a 2.5^{th} percentile and 97.5^{th} percentile at 2.3 and 7.6 cm, respectively (14). This data supports the use of cut-offs of 2 cm and 8 cm to define oligohydramnios and polyhydramnios in twin gestation respectively and these limits have been used in the diagnosis of twin-twin transfusion syndrome in monochorionic pregnancies (15).

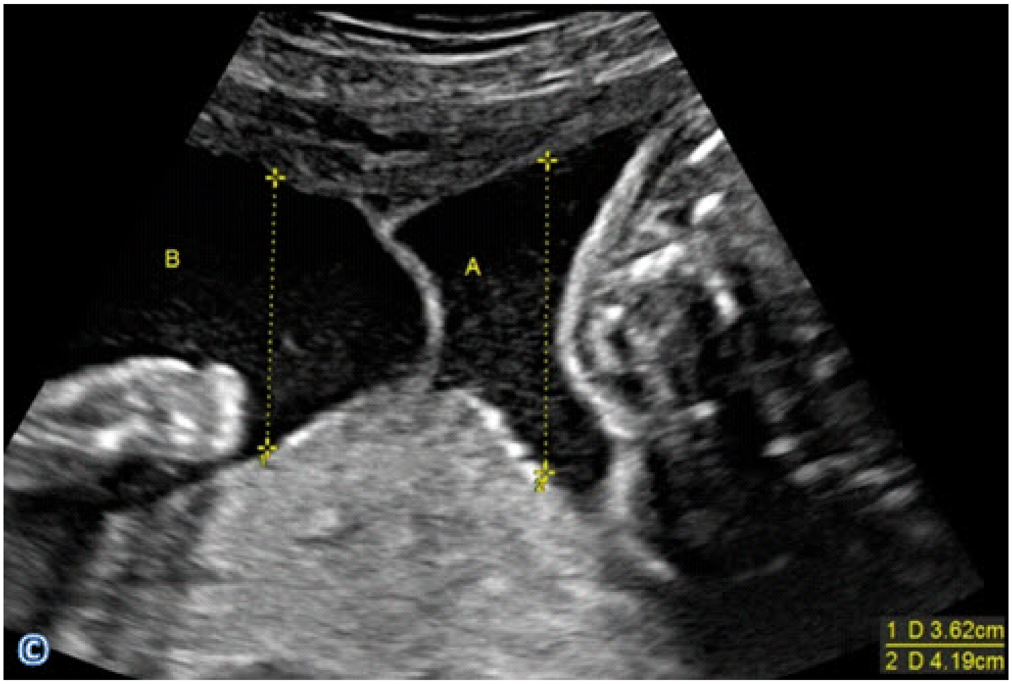

Figure 9.8: Amniotic fluid assessment in twin gestation using the Maximal Vertical Pocket (MVP) measurement in each gestational sac. Note that the MVP measured 4.1 cm in sac A and 3.6 cm in sac B.

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