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various injuries is safe for the fetus. Doses of radiation used during trauma care and evaluation—for example, CT scans of the pelvis or chest, and chest x-rays—are usually in the range of less than 250 mGy, which is considered to be the intermediate range of exposure and reasonably safe for the fetus.

Whenever possible, the pelvis of a pregnant woman should be shielded, especially in the first trimester. It is important to know, however, that much of today's imaging equipment is faster than previous technology and therefore delivers much lower radiation exposure with more information in a single pass. Additionally, MRI has been shown to be a safe modality in pregnancy.

The bottom line is that imaging studies that are needed for the care of the critically injured patient should not be withheld because she may be pregnant.

Primary Assessment

On initial presentation, all efforts for the pregnant trauma patient must first be directed toward stabilizing the mother and maintaining oxygen delivery, with the ABCs (airway, breathing, and circulation) of trauma care being the first priority.

Women who are pregnant have a reduced ability to compensate for respiratory compromise. Maintaining a patent airway is critical for both maternal and fetal oxygenation, and this very well may require early intubation. We must make sure that the patient is moving oxygen in, with oxygen saturation levels better than 90%.

The fetus's oxygen uptake depends directly on oxygen delivery via uterine blood flow, so circulation—both to the mother's vital organs and to the uterus—is also key. Because of shunting and vasospasm, significant uterine blood flow compromise may exist even with normal-appearing blood pressure. Thus, it is important to control any significant bleeding and pursue vigorous volume replacement.

Only after the ABCs are addressed—and readdressed for effectiveness—can we turn

our attention elsewhere. If we were to add a "D" to the trauma protocol, it would stand for "disability" and would involve a rapid neurologic evaluation to assess for any neurologic injury. It is worth considering that neurologic impairment in late pregnancy may be secondary to an eclamptic seizure that may have led to the trauma event.

Other often critical components of trauma injuries, such as fractures and intraperitoneal hemorrhage, are usually evaluated almost simultaneously by the trauma team.

Patients with pelvic fractures (common in motor vehicle accidents) are at risk of having retroperitoneal hemorrhage, which is not always obvious and requires careful diagnosis. A pelvic exam can reveal signs of lower pelvic fracture and possible vaginal lacerations from protruding bone fragments.

The Secondary Survey

Once we have stabilized the mother and evaluated her for other critical signs of trauma, we can turn our attention to fetal assessment. First, we should assess gestational age, either by taking a history if someone close to the mother is present, or through ultrasonography.

Ultrasonography is an important tool at this point for assessing several factors in short order. In addition to assessing the viability of the fetus, we can evaluate the intrauterine fluid volume and the placental location. (The question of viability, of course, depends on the level of neonatal intensive care services available).

A low amount of amniotic fluid should lead us to suspect rupture of the amniotic membranes or, in some cases, uterine rupture secondary to trauma. Although with expert hands it is possible to detect relatively small placental abruptions, abruptions are usually apparent only with larger separations.

Ultrasonography can also be used in de-



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termining intra-abdominal free fluid which is consistent with intraperitoneal hemorrhage.

When the woman is severely injured and needs surgery and if delivery of the fetus is unnecessary, we should focus on monitoring the fetus in the operating room. We can do so with an ultrasound probe or a fetal Doppler encased in a sterile sleeve.

After surgery—or when the woman does not need surgery and is considered stable enough to undergo observation—continuous monitoring of the viable fetus, with a longer-term view, should be done using external monitoring of fetal heart rate and uterine monitoring for signs of preterm labor. Frequent uterine contractions should be followed closely, and cervical dilatation should be evaluated.

The ob.gyn. becomes the primary provider when a viable fetus shows signs of fetal compromise that necessitate delivery, or when uterine rupture occurs, in which case urgent intervention is necessary for the mother.

Many studies have attempted to address

the question of how long trauma patients should be monitored, and many guidelines have been proposed. In general, we can conclude that 12 hours of observation is adequate for stable patients who are not contracting and have reassuring fetal tracings and no signs of bleeding.

On the other hand, patients who are contracting, who have a nonreassuring fetal tracing, or who have had any form of vaginal bleeding should be observed for a minimum of 24 hours. The more severe the injury to the mother, the more likely there is to be an injury to the fetus, and the higher the risk that a placental abruption or other serious complication may surface.

If a patient is discharged after observation, regardless of the severity of trauma, she must be given precautions regarding any changes in fetal movement or the development of abdominal pain, vaginal bleeding, or fluid loss. Any one of these changes should prompt her to return for evaluation immediately.

The Kleihauer-Betke test may be useful in evaluating the degree of fetal-maternal hemorrhage and the amount of Rh immune globulin that may be needed in the Rh-negative mother. In general, Rh-negative mothers who are involved in trauma should be given a single dose of Rh immune globulin unless it is known that the fetus is Rh negative.

Cardiac arrest is sometimes the tragic outcome for a posttrauma victim. Maternal resuscitation should be undertaken immediately. If maternal resuscitation is not thought likely to be effective, and the fetus is considered viable, the best outcome for fetal survival occurs if delivery can be accomplished within approximately 5 minutes from arrest. Beyond this time, there is diminishing return for fetal survival.

Organized, rapid assessment and intervention hold the key to the best outcomes for the pregnant patient involved in a trauma. Following the rules of trauma resuscitation (those ABCs) provides the best chance of successful treatment of the mother, which in turn provides the best chance of a favorable fetal outcome. ■

Team Is Vital for Gravidas With Congenital Aortic Stenosis

BY BRUCE JANCIN
Denver Bureau

BARCELONA — Complications occurred in nearly three-quarters of completed pregnancies in the largest-ever reported patient series involving women with congenital aortic stenosis, Dr. Sing-Chien Yap said at the joint congress of the European Society of Cardiology and the World Heart Federation.

Cardiac complications were common but for the most part nonsevere and readily manageable.

However, there were also high rates of general medical, obstetric, and neonatal complications. This underscores the merits of a team approach to management of pregnancy in adults with con-

genital aortic stenosis, with involvement of a cardiologist, neonatologist, and obstetrician, stressed Dr. Yap, a cardiologist at Erasmus University, Rotterdam, the Netherlands.

He reported on 48 women with congenital aortic stenosis who collectively had 70 completed pregnancies, defined as being of more than 20 weeks' duration. The women were part of the larger ZAHARA study, a Dutch nationwide retrospective study investigating pregnancy outcomes in women with all forms of congenital heart disease.

ZAHARA was undertaken with funding from the Netherlands Heart Foundation because treatment advances have resulted in far more women with congenital heart disease surviving

into their childbearing years than was historically the case. Few data exist on the risk factors for and nature and frequency of pregnancy complications in these women, Dr. Yap explained.

Thirty-five of the women had valvular aortic stenosis, 11 had subvalvular disease, and the remainder had supra- or aortic stenosis. Prepregnancy, 9 had severe aortic stenosis as defined by a valvular gradient in excess of 64 mm Hg, 17 had moderate aortic stenosis with a gradient of 36-44 mm Hg, and the rest had mild aortic stenosis. Mean gradients were unchanged after pregnancy.

The most common cardiac complication of pregnancy was deterioration in New York Heart Association functional class. It occurred during 19 of 70 pregnan-

cies and persisted for longer than 1 year postpartum in 3. Heart failure occurred in two patients, both with severe aortic stenosis. Angina occurred in two patients. Four patients developed arrhythmias, mainly supraventricular arrhythmias treated with β -blockers.

Seventeen women required hospitalization for general pregnancy disorders, most of which were hypertension related. There were six cases of isolated pregnancy-induced hypertension, three of preeclampsia, and one of eclampsia. Three women were hospitalized for dyspnea. One woman experienced a transient ischemic attack despite being on warfarin for atrial fibrillation.

Eight women had elective cesarean deliveries, and 11 had emergency cesarean sections.

There were three cases of placental abruption and two of postpartum hemorrhage.

Mean pregnancy duration was 38.2 weeks. Eleven babies were born small for gestational age. There were 10 preterm deliveries. One neonate died as a consequence of prematurity. Two children were born with congenital heart disease.

Most of these complications occurred at significantly higher rates than in the general Dutch pregnant population. Complication rates were highest in women with severe aortic stenosis.

Because of the limitations inherent in a retrospective study, the investigators have launched a prospective nationwide study of pregnancy in congenital heart disease, according to Dr. Yap. ■