American College of Radiology
ACR Appropriateness Criteria®

Clinical Condition: **Multiple Gestations**

Variant 1: **Patients with high index of suspicion for multiple gestations—assisted reproductive techniques, large dates for pregnancy, and elevated maternal serum alphafetoprotein.**

Radiologic Procedure	Rating	Comments	RRL*
US pregnant uterus transabdominal or transvaginal	9		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Variant 2: **Patients with low index of suspicion for multiple gestations—all pregnancies or family history of twins.**

Radiologic Procedure	Rating	Comments	RRL*
US pregnant uterus transabdominal or transvaginal	9		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Variant 3: **Initial ultrasound has diagnosed twins on the same scan.**

Radiologic Procedure	Rating	Comments	RRL*
On the Same US Exam			
US pregnant uterus (transabdominal or transvaginal) determine chorionicity and amnionicity	9		O
US pregnant uterus (transabdominal or transvaginal) detailed anatomic survey	9	Fetal anomalies are more frequent in twins than in singletons.	O
US pregnant uterus (transabdominal or transvaginal) assess amniotic fluid	9	Frequency of follow-up examinations is usually based on chorionicity and size concordance. See narrative.	O
US pregnant uterus (transabdominal or transvaginal) assess twin sizes and discordancy	9	Frequency of follow-up examinations is usually based on chorionicity and size concordance. See narrative.	O
US pregnant uterus (transabdominal or transvaginal) assess cervix	9	Frequency of follow-up examinations is usually based on chorionicity and size concordance. See narrative.	O
US pregnant uterus (transabdominal or transvaginal) umbilical artery Doppler for each twin	3	Frequency of follow-up examinations is usually based on chorionicity and size concordance. See narrative.	O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Clinical Condition: **Multiple Gestations**

Variant 4: **Parameters to measure for twin discordance.**

Radiologic Procedure	Rating	Comments	RRL*
Measurement Parameter			
US pregnant uterus (transabdominal or transvaginal) abdominal circumference	9	Same table to be used as singletons.	O
US pregnant uterus (transabdominal or transvaginal) weight	9	Same table to be used as singletons. Weight based upon a standard regression equation using measurements of at least three parameters.	O
US pregnant uterus (transabdominal or transvaginal) biparietal diameter	9	Same table to be used as singletons.	O
US pregnant uterus (transabdominal or transvaginal) head circumference	9	Same table to be used as singletons.	O
US pregnant uterus (transabdominal or transvaginal) femur	9	Same table to be used as singletons.	O
US pregnant uterus (transabdominal or transvaginal) head/abdomen circumference ratio	6	Same table to be used as singletons.	O
US pregnant uterus (transabdominal or transvaginal) femur/abdominal circumference ratio	3	Same table to be used as singletons.	O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

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Summary of Literature Review

All multiple gestations are high-risk compared with singleton pregnancies [1,2]. Dichorionic twin pregnancies, all of which must also be diamniotic, are the safest form of twinning and carry a 10% risk that one or both fetuses will not survive beyond the neonatal period. When twins share one placenta—monochorionic-diamniotic twinning—that risk increases to 25%, with the increased mortality due to complications related to blood vessel communications between the cardiovascular circulations of the individual twins. These conditions include twin-twin transfusion syndrome (TTTS), twin embolization syndrome, and acardius, or twin-reversed arterial perfusion sequence. When twins also share the same compartment—monochorionic-monoamniotic twinning—the loss rate jumps to 50%, with the incremental mortality attributable to cord entanglement accidents.

The major sources of morbidity and mortality common to all twin gestations are prematurity and intrauterine growth restriction, which may affect one or both fetuses. There may be an earlier onset to placental postmaturity complications. There is also an increased incidence of congenital anomalies among all twins, although anatomic malformations occur four to five times more frequently in monozygotic than in dizygotic twins [3]. The overall risk for at least one of a monochorionic/monoamniotic twin pair having a structural congenital cardiac anomaly is eight times that of a monochorionic/diamniotic twin pair. In addition, if one of a pair of monochorionic twins is affected, the risk to the other twin for a cardiac anomaly is also higher [4]. All categories of perinatal morbidity and mortality among twins occur with even greater frequency in higher-order multiple gestations [5].

It has been the task of this committee to determine, by evaluation of the medical literature and use of consensus techniques, the timing and frequency for assessing the health status of multiple gestations. To date, in spite of the increasing incidence of multifetal pregnancies related to assisted reproduction, there is lack of medical literature regarding imaging schedules for diagnosis and follow-up in this population. The appropriateness criteria presented here have been revised to address diagnosing a multiple gestation in the first trimester, with a scan for detailed anatomic evaluation and comparative growth at 18-20 weeks. Triplet and higher-order multiple gestations are not specifically addressed, but these should all be treated as very-high-risk pregnancies.

Growth scans should be performed at least every 3-4 weeks. Some form of fetal monitoring, probably best accomplished by some variant of the sonographic biophysical profile (since it is very difficult to confirm that nonstress tests have successfully interrogated each fetus of a triplet or greater multifetal pregnancy), should be considered on a weekly or more frequent basis once the pregnancy has reached the point of potential postnatal viability. Even closer surveillance may be indicated if there is a monochorionic or monoamniotic twin pair as part of the multifetal pregnancy, particularly if there is discordance in fetal sizes or amniotic fluid volumes.

Initial Ultrasound Exam

Determination of multiple gestation in the first trimester is important for several reasons. Monochorionic twins and triplets are at a higher risk for twin twin transfusion, fetal growth restriction, congenital anomalies, vasa previa, velamentous insertion of the umbilical cord, and fetal death. Because of the increased morbidity and mortality directly related to problems resulting from chorionicity, establishment of placentation, amnionicity, and chorionicity is essential in implementing an antepartum management strategy [6-11]. Because of the high risk of perinatal loss, multifetal pregnancy reduction is often offered to reduce number of fetuses with the hope of optimizing the outcome for the remaining fetuses. Chorionicity must be determined prior to reduction because the presence of vascular anastomoses in monochorionic gestations increases the risk of injury or damage to the remaining fetuses [12].

The first trimester is considered the most optimal time to diagnose chorionicity with ultrasound (US) [8,13]. Sonographic assignment of monochorionicity during the first trimester had higher sensitivity, specificity, and positive and negative predictive values than assignment during the second trimester [14]. As with twins, the techniques of sonographic determination of chorionicity can be applied to other multiple gestations with a high degree of accuracy.

Because first-trimester US for pregnancy is not universally routine, the early diagnosis of multiple gestation via US relies on maintaining a high index of

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suspicion in patients with uterine size greater than expected for dates, a history of assisted reproduction, and elevation of maternal serum alpha-fetoprotein [15,16]. Detection rates for multiple gestation in the first trimester approach 99.3% [17]. In the RADIUS trial, 129 multifetal pregnancies were studied. Those screened with US were consistently diagnosed earlier than those not screened. In spite of this, no statistically significant fetal benefits were demonstrated in those who were screened in this trial [18].

During the initial scan it is also important to assess the size of each twin and the degree of discordance, if any, between them; to evaluate the amount of amniotic fluid for each; and to image the cervix to check for changes of effacement or dilatation [19].

Follow-up Ultrasound Exam/Antepartum Surveillance

Tests for evaluating fetal well-being include sonographic assessment of fetal growth and amniotic fluid volume, umbilical artery Doppler, nonstress test (NST), and biophysical profile (BPP). NST and Doppler are considered more predictive of fetal well-being than the other two [20], because of the inaccuracy of amniotic fluid volume estimation in multiple gestations.

Hartley et al [21] showed that growth restriction confers worse perinatal outcome in twins when compared with singletons. Serial US scans to assess fetal weight and growth should be done every 3-4 weeks from 18-20 weeks until delivery [16]. Others advocate follow-up beginning at 28 weeks since fetal growth in twin pregnancies mirrors singleton growth until 28 to 32 weeks [22,23]. There are others that advocate the use of twin growth charts in the third trimester. Fetal growth in twin and multifetal pregnancies after 30 weeks of gestation lags behind the growth of singleton pregnancies. Therefore, 2- to 4-week intervals for serial US scans to monitor interval growth in the third trimester is recommended by D'Alton and Mercer [24].

If growth discordance (>20% to 30%, calculated as a percentage of the larger twin's weight) or growth restriction (<10%) is discovered, US is recommended every 2 weeks [16]. Optimal detection of fetal growth deceleration leading to growth discordance is between 20 and 28 weeks [25]. Doppler testing has been validated in multifetal gestations; the values and patterns of change in vascular resistance are the same as for singletons [26].

Weekly surveillance for all multifetal pregnancies has not been validated in prospective studies. Surveillance with nonstress testing or biophysical profile for pregnancies complicated by abnormal fluid volumes, pregnancy-induced hypertension, fetal anomalies, growth abnormalities, monoamnionicity, or other standard obstetric indications is as reliable in multiple gestations as in singleton gestations [27].

The necessary parameters to measure or calculate in assessing the likelihood of intrauterine growth restriction include weight and abdominal circumference [28-30]. Measurements of biparietal diameter, head circumference, and femur length are all indicated, but ratios of head or femur to abdominal circumference are probably not needed. The use of the same measurement tables developed for singleton pregnancies is indicated for twins, rather than tables specifically generated for twins [31,32]. Twin pregnancies are at greater risk of intrauterine growth restriction, which may affect one or both fetuses, and there is concern that growth tables for twins, which do show smaller measurements than singletons in the third trimester, may be incorporating tendencies toward growth restriction within their normal values. It is important to remember that twins can be concordantly growth-restricted, and if both are becoming small for dates on follow-up sonograms, protocols for monitoring fetal well-being will still be indicated, just as they would be in significantly discordant twins.

Discordant fetal growth is seen in a significant proportion of twin pregnancies. The abdominal circumference ratio has been shown to be a good predictor of birth weight discordance, and it can be added to the follow-up protocol [33]. Discordance is considered mild if weight estimates for the twins are 15% different, moderate if 20% different, and severe if 25% different or greater [34]. For mild discordance, scans for growth at 3-week intervals with use of umbilical artery Doppler (UAD) analysis are probably indicated. For moderate discordance, scans for growth at 2-3-week intervals should be considered, and UAD, BPP, and/or NST are indicated. When discordance is severe, growth scans at 2-week intervals are preferred, with BPP and/or NST necessary and UAD also indicated. If both twins have fallen below the 10th percentile for gestational age relative to menstrual dates and/or dating by the initial sonogram, that should also be taken as an indication for increased surveillance of growth and fetal health.

Oligohydramnios in one or both sacs may indicate uteroplacental insufficiency necessitating further testing to screen for fetal well-being. It may also be an early sign of TTTS if the other twin is presenting with polyhydramnios. If deemed abnormal, fetal well-being scans (which may include BPP, NTS, and UAD) are recommended every 2 weeks. Therefore amniotic fluid determination is another standard parameter evaluated during the routine sonographic examination [35].

UAD is, in general, not a rapidly fluctuating or deteriorating parameter, but rather a long-term predictor of the status of the uteroplacental circulation [36,37]. As such, it has prognostic significance for the likelihood of growth restriction and perinatal morbidity and mortality, and it may change weekly if abnormal [38]. Doppler assessment of umbilical venous blood flow and systolic/diastolic ratios is considered useful in predicting and confirming concordant and discordant growth in twins. Absent end diastolic flow is associated with low birth weight, growth restriction, and perinatal mortality in triplet and quadruplet pregnancies [39,40].

On each indicated follow-up sonogram, it remains equally important to measure twins for development of

discordance, and to evaluate the cervix and each twin's amniotic fluid. Transvaginal sonography has been shown to be able to accurately assess cervical length and predict spontaneous delivery before 34 weeks as early as the 27th or even the 23rd week [41,42]. A large multicenter study of cervical length in twin pregnancies determined that a cervical length of less than 25 mm at 24 weeks gestation was the best predictor of delivery before 32 weeks of gestation and was significantly more common in the 24th and 28th weeks of gestation in twin gestations compared with singletons [43].

Approximately 10%-20% of monochorionic twin pregnancies may be associated with TTTS, a type of twin discordance. In addition to the evaluation of amniotic fluid volume, bladder volume, and hydrops in each twin, Doppler findings may be used to assess these pregnancies complicated by intertwin vascular connections within the placenta, between cord insertion sites, for the presence of an arterio-arterial anastomosis. Other Doppler findings include absent or reversed end-diastolic flow within the umbilical artery, pulsatile umbilical vein flow, and absent or reversed end-diastolic flow within the ductus venosus [44,45].

The most effective fetal surveillance system for multiple gestations is currently not known. The gestational age at which testing should be initiated is still not established. It is also still unclear whether testing should be performed once or more than once per week or whether there is a need to test normally growing dichorionic twins. There are no current studies that prove that routine antepartum surveillance provides objective benefit in the absence of other high-risk conditions [46]. At present, antepartum fetal testing in multiple gestations is recommended in all situations in which surveillance would ordinarily be performed in a singleton pregnancy (including in utero growth retardation). In the most recent practice bulletin of the American College of Obstetricians and Gynecologists, the recommendation based on consensus and expert opinion was that the management of discordant growth restriction or death of one fetus in a high-order multiple gestation should be individualized, taking into consideration the welfare of the other fetuses [46].

Summary

The evaluation of multiple gestations is a challenging and important task. The intensity of the obstetrical management of such pregnancies must be titrated to the degree of risk present in each individual case. The number of fetuses present, their chorionic and amniotic status, and risk factors such as growth restriction of one or more fetuses, amniotic fluid alterations, or presence of fetal anomalies must all be taken into account. These parameters will all affect the frequency of growth assessment, the intensity of surveillance for fetal well-being, and the institution of pharmacological and other medical therapeutic interventions. Ultrasonographic imaging, together with its associated techniques for monitoring fetal compensation or distress, serves as the mainstay for evaluating the complexities of each multifetal pregnancy, helping the obstetrician chart a course toward a successful outcome.

Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults (see Table below). Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document.

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv
☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv
☢☢☢☢☢	30-100 mSv	10-30 mSv

*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (eg, region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as NS (not specified).

Supporting Document(s)

- ACR Appropriateness Criteria® Overview
- Procedure Contrast Information
- Evidence Table

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The ACR Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the FDA have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.