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• *Clinical Note*

Perioperative radiation exposure in a pregnant woman

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The perioperative imaging of a pregnant woman presents a unique challenge to orthopaedics surgeon as concern about the radiation risk to the embryo or fetus. This article highlights effect of radiation exposure on foetus.

I would like to discuss about the amount of radiation exposure in a pregnant woman during fluoroscopic guided closed femoral Interlock nailing as radiation has significant cancerous and non cancerous effect on fetus.

Trauma is one the leading nonobstetric cause of maternal death in as many as 8% of pregnancies [1]. The principal causes of trauma in pregnancy include motor vehicle accidents. Domestic falls, domestic violence, and penetrating wounds are involved in 10% of trauma during pregnancy [1]. Diagnosis and treatment of fracture of the long bone of the lower limb in pregnant patients has it own peculiar risk of exposing foetus to ionizing radiations during X-ray evaluation and image intensifier guided treatment, which may lead to abnormal embryogenesis and congenital anomaly [2].

A 30 year old with presented at 24 week gestation of pregnancy who got injured when a broken wall accidently fell over her right lower limb. She was brought to the Acharya Vinoba Bhave Rural Hospital accident and emergency department with signs of hypovolumic shock. She was resuscitated with volume and blood transfusion and fetal wellbeing was assured with ultrasonography thereafter. On examination of abdomen uterine fundus was palpable just above the level of the umbilicus. Ultrasonography confirmed a gravid uterus of 24 weeks gestational age, with fetal heart rate of 130 per minute. She did not suffer any other injury. X-ray was taken after shielding the abdomen, revealed a displaced comminuted fracture of the right femur (figure 1). Patient and her relatives were counseled about the management and its outcome stressing upon the radiation exposure and its subsequent sequeal.

Closed reduction and Intramedullary Interlocking nail was done with the help of guarded fluoroscopy. Distal interlocking was done without using image intensifier. Post operative radiograph showed good reduction, implant position and locking bolts (figure 2).

We protected the patient and foetus from radiation exposure by draping the lead sheet over her abdomen from all around. Excess radiation exposure was prevented by using minimum number of shots of image intensifier.

She was discharged from the ward after an appointment with the Obstetrician. Obstetrician planned for elective caesarean section at completion of 39 weeks of gestation. Baby and mother were normal at the time of discharge from the obstetrics ward. Patient regained her previous functional status.

Maximal permissible ionizing radiation from X rays for upper or lower extremity is 100 mGy units [2]. Exposure beyond 100 mGy (1 mGy =100 mrad) may cause cancerous effects on fetus during first trimester of pregnancy [3, 4]. Non cancerous effects on the embryo or fetus

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Figure 1

Figure 2

include miscarriage, fetal growth restriction, congenital malformation, and mental retardation [2, 4]. Mental retardation, in terms of IQ loss, has been noted with radiation exposure during 8 to 15 weeks gestation [4]. The maximum recommended dose by the National Council on Radiation Protection during Pregnancy is 50 mGy (5 rad) [5]. The estimation of radiation dose in fluoroscopic guided orthopaedics procedure and consequences has not been elaborated clearly in literature. Ioannis et al estimated entrance surface dose by using mathematical method for interlocking femoral nailing [6]. Mean radiation entrance surface dose for fluoroscopic guided femoral interlocking nail was around 331 mGy and mean fluoroscopic time was 6.3 minute [6]. Radiation dose is proportional to fluoroscopic time utilized which also reflects difficulty level of surgery [4, 7]. As femoral interlock nailing requires higher fluoroscopic time and radiation exposure to the patient, radiation reduction measures should be taken in order to prevent radiation induced foetus damage in a pregnant woman. Furthermore, probability of scattered radiation will be approximately 24 times less behind the lead screen [7]. Thus use lead sheet as drape in a pregnant woman reduces the chance of direct and scattered radiation to the fetus. Modification of operative technique can reduce amount of radiation exposure to the pregnant patient.

The usual fear for surgery and anaesthesia in the pregnant patient is the risk of induced abortion, and radiation adds further risk to the patient and foetus. Constant worry and hesitation on behalf of surgeon to use radiation in a pregnant woman makes him to limit the number of exposures during surgery which can adversely affect the course of procedure. However the safest approach to the treatment of fractures in a pregnancy of would depend on the gestational age of fetus and amount of radiation exposed. Surprisingly, literature on radiation exposure and operative treatment of fractures in the pregnancy is scanty.

In summary, radiation dosimetry for the fetus is highly unreliable. Pregnant women who were exposed to X-ray of extremities can be counseled that there will be minimum risk of miscarriage, fetal growth restriction, congenital malformation or mental retardation. Pregnant women who are undergoing fluoroscopic guided orthopaedics procedures care should be taken to reduce fluoroscopic time and radiation protection.

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