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Position Statement

Supporting pregnancy and parental responsibility in orthopaedic training and profession

This Position Statement was developed as an educational tool based on the opinion of the authors. It is not a product of a systematic review. Readers are encouraged to consider the information presented and reach their own conclusions.

Pregnancy, childbirth, and early support of an infant present challenges to male and female surgeons alike. The Ruth Jackson Orthopaedic Society, with a mission to promote professional development of women in the field, recognizes that many factors are unique to women who are orthopaedic surgeons. Women represent only 6% of board-certified orthopaedic surgeons and 14% in training, thus the profession has less experience with surgeon maternity issues than other medical specialties[1]. Further, the combination of rigorous training during peak fertility years and risks specific to the practice of orthopaedic surgery (e.g. exposure to radiation and PMMA in bone cement) contribute to challenges faced by female orthopaedic surgeons[2].

The Ruth Jackson Orthopaedic Society (RJOS) believes that balancing a career in orthopaedic surgery with pregnancy and motherhood can be achieved skillfully with the education and support of those around mothers in orthopaedics. Promoting an understanding of barriers to maternity as an orthopaedic surgeon as well as developing tools to address such barriers should be a goal for the profession, as attracting female medical students continues to be a key consideration in addressing the gender gap among orthopaedic surgeons.

The following document will present an outline of general considerations for maternal needs among orthopaedists and will conclude with special attention to the orthopaedic surgeon in training, as this constitutes a vulnerable population within the profession.

Pregnancy considerations for orthopaedic surgeons

Radiation Exposure

Radiation exposure is well known to be increased in orthopaedic operating rooms. Though consensus on limits of exposure to ionizing radiation in pregnant patients and healthcare workers vary widely, ACOG Committee Opinion states that exposure of <5 rads (50 mSv or 50 mGy) is not harmful to the fetus[3,4]. Effects on the fetus depend on amount of radiation received and gestational age of the fetus at time of exposure. Risk is greatest at 3 to 8 weeks of gestation, during organogenesis through adverse effects due to cell death or damage to DNA[5]. The effected of radiation-induced DNA damage are cumulative, and children who received prenatal exposure to radiation had a relative risk of 1.47 of developing childhood malignancy, though this dose effect associated with this risk is not well understood[6].

There are a number of strategies available to the pregnant orthopaedist to reduce the risk of radiation exposure, and every facility should have a Radiation Safety Officer or specialist who can work specifically with the surgeon should she need equipment, dosimeter, or advice[7,8]. Positioning the x-ray source posterior to the patient and reducing exposure time each reduce ionizing radiation delivered to the operating surgeon[9]. Giachino and Cheng demonstrated a 750-fold reduction in radiation was noted when the measuring equipment was moved 18 in from the fluoroscope[10]. A standard 0.25mm lead apron blocks 96% of radiation, and maternity aprons with 0.5 to 1 mm lead thickness are available that absorb over 99% of radiation[5]. However, these aprons are 1.5-times the weight of a standard apron, and the benefits of reduced radiation exposure must be weighed against the increased physical stress of increased weight.

The RJOS recommends that hospitals, clinics, and training programs provide safety equipment including maternity-grade lead aprons. RJOS encourages such facilities to maintain at least one maternity-grade lead apron per 20 operative full time female employees between the ages of 20 and 50 years of age. Dosimeters should be utilized, and sensitivity should be practiced in positioning team members during fluoroscopy so that, if a pregnant individual is present, she may be positioned at greater distance from the radiation source.

Chemical Exposures

Exposure to harmful chemicals in the operating room can pose serious risk to pregnant mothers and fetuses. Anesthetic gases such as nitrous oxide and halogenated agents are known to cause an inhibitory effect on dividing cell lines and chromosomal abnormalities[11]. Proximity to patients during induction may expose a surgeon to increased levels of these anesthetic gases, and leaks in tubing may lead to exposure above recommended values[12].

Similar to anesthetic gases, methylmethacrylate (MMA) can be toxic to various tissues at elevated levels and can be specifically toxic to developing fetuses[12–15]. The US EPA has set the limit for exposure to <100 ppm over an 8-hour period[12], and animal models demonstrate fetotoxicity at levels >1,000 ppm[13]. Darre *et al.* demonstrated this level of exposure occurs during a single total joint replacement[16] with greatest exposure during the mixing process[17]. In spite of theoretical concern of toxicity based on animal models, serum and breast milk levels of MMA in two breastfeeding surgeons following exposure to MMA during joint arthroplasty had levels no different than controls[18].

The RJOS recommends that an effort is made to reduce exposure of pregnant surgeons to potentially fetotoxic chemicals. In all cases, positioning should be performed after completion of induction in order to decrease proximity to inhaled anesthetics. In cases where an otherwise adequately trained staff member is available, cement mixing should be performed by a non-pregnant team member.

Blood-borne Pathogens

Reported rates of percutaneous injury during orthopaedic surgery range from 1.7% to 15%[19,20]. Hepatitis B, Hepatitis C, and HIV are the three main pathogens of concern with regards to blood borne exposures in the operating room; however, mucocutaneous exposure is likely underreported in the literature and poses a greater risk to orthopaedic surgeons given frequent use of power tools and pulse irrigation, which create a splatter effect.

Post-exposure prophylaxis protocols vary from typical protocols in the setting of pregnancy. Hepatitis B, Hepatitis C, and HIV each pose a risk of vertical transmission (Table 1). Additionally, post-exposure prophylaxis regimens pose a risk of toxicity to fetuses and breastfeeding newborns, and dosing must be altered to reflect these concerns.

Simple safety precautions can decrease the risk of exposure in high risk surgical settings such as operating on a patient with known infection with one of the aforementioned pathogens. Every health care facility must provide eye protection under Joint Commission mandate[21]. Needle puncture resistant surgical gloves, finger guards, and glove liners are more resistant to needle stick as compared to typical surgical gloves[22]. Surgical hoods decrease mucocutaneous exposure by protecting the face of surgical team members from splatter while using power tools and pulse irrigation[23].

RJOS strongly recommends the use of typical safety precautions such as gown, facemask, eye protection and gloves for all physicians. Additional safety equipment such as Kevlar gloves and hoods should be readily available to all staff members and their use should be unequivocally supported, particularly in high risk settings.

Maternity leave and workplace support of new mothers

The timing in which to start a family is a highly personal decision. However, given the lengthy nature of medical school education and residency, there is often consideration whether to start a family during training or wait until completion. Among orthopaedic trainees, there may be a perception of burden to co-residents or fellows and an idea that greater control may be attained as an attending physician. During residency, lack of sleep and limited income or support may make it logistically more difficult to have children. However, delaying pregnancy may risk decreased fertility[24], as the average orthopaedic trainee completes fellowship between the ages of 32 and 36. There are some advantages to waiting to start a family until after residency. As an attending, a woman's salary is significantly higher, which improves the woman's ability to support a family and afford childcare. Additionally, due to increased autonomy, there may be more ability to negotiate a flexible work schedule.

Complications for the baby increase with advanced maternal age and include preterm birth, poor fetal growth, low birth weight, and neonatal mortality.

Maternity in training

Current AGCME and ABOS requirements for training require completion of an intern year with 6 months of orthopaedic training along with 6 months of non-orthopaedic rotations. The PGY 2-5 years must include at least 36 months of rotations on orthopaedic services with a minimum completion of 1000 cases to meet case log requirements over the course of training[25]. While these requirements are stringent, they do afford a fair amount of flexibility. The recent shift toward subspecialty focus has led to increased elective rotations during surgical training[26], which could be flexible to accommodate the needs of family planning.

RJOS recognizes and agrees that completion of all training is fundamental to prepare competent orthopaedic surgeons. However, RJOS encourages the American Board of Orthopaedic Surgery, Department Chairs as well as Residency and Fellowship Program Directors, to work creatively to support safe pregnancy and delivery. Establishing a maternity leave policy provides clarity to the pregnant trainees and faculty. A clear and succinct policy establishes a safe groundwork in which to begin family planning among trainees. Time and work restriction, including on call demands, are critical considerations, and making certain that these considerations are appropriately accounted for protects both the trainee and the training program. The goal is for all trainees to feel valued and protected, and not overworked or taken advantage of when a maternity plan occurs.

Maternity in practice

Typically, there is a fair amount of autonomy once in practice. However, this is highly dependent on the practice structure. Different practice structures result in variable maternal and parental leave policies, and there is further inconsistency between state-based leave guidelines.

Policies should clearly outline any impact of leave on vacation or sick time and should also include provision of expectations for any commensurate call responsibilities. Policies should, at a minimum, be in accordance with government guidelines, and employees who utilize their leave to its fullest extent should not be penalized professionally or socially.

Under the Family and Medical Leave Act, mothers may take leave from public facilities for pregnancy, adoption, or care of a family member and cannot be penalized for this leave. “FMLA applies to all public agencies, all public and private elementary and secondary schools, and companies with 50 or more employees.” These employers must provide an eligible employee with up to 12 weeks of unpaid leave each year for any of the following reasons:

- for the birth and care of the newborn child of an employee;
- for placement with the employee of a child for adoption or foster care;
- to care for an immediate family member (spouse, child, or parent) with a serious health condition; or
- to take medical leave when the employee is unable to work because of a serious health condition.”[27]

The RJOS believes that women and men of all levels should be familiar with their practice's maternal and parental leave policies. However, the RJOS also encourages senior partners and employers to work creatively to support safe pregnancy and delivery. For those in the position to shape their own practices guidelines, the RJOS encourages the development of a clear maternal and parental leave policy for all orthopaedic practices. In the development of such policies, there should be consideration of the physical demands required to return to the operating room after childbirth.

Lactation

Women who choose to continue breast-feeding after returning to orthopaedic practice or training must regularly use a breast pump to obtain milk for the infant, but also to maintain milk production. While breastfeeding laws vary by state, the Patient Protection and Affordable Care Act protects mothers who choose to pump breast milk at work[28]. Federal law mandates reasonable break time for mothers to express breast milk for up to one year after giving birth, and lactation rooms are federally mandated for up to one year (a bathroom does not qualify)[29]. Electric pumps can make the process efficient, allowing for pumping between cases or during a clinic break. Pumping requires a private environment and employers are required to provide a private room free of intrusions for the mother including electricity supply, and a bathroom does not qualify[30]. Orthopaedic surgeons who are required to return to work after a short maternity leave may not have the opportunity to establish a strong milk supply at home, thereby making it necessary to be provided with adequate time and resources to maintain a supply when returning to work.

RJOS supports the provision of private, designated areas for lactation in both operating room and clinic settings, as well appropriate break time for pumping that will not interfere with routine patient care.

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Table 1

Pathogen	Hepatitis B	Hepatitis C	HIV
Mode of Maternofetal Transmission	Delivery	Placental	Late in pregnancy, delivery, or during breast feeding
Risk of Transmission	Infection status: 90% risk if seropositive for both hepatitis B surface antigen and e-antigen. If non-active infection risk ranges from 3-10% Timing: first trimester 10% transmission rate, third trimester 80-90% rate	Not reported	Directly related to the HIV RNA load
Prevention of Transmission	Immunization	None available	Highly active antiretroviral therapy may reduce the vertical transmission rate to <2% if the maternal viral load can be reduced to <1,000 copies/mL
Post-Exposure Prophylaxis Alterations in Pregnancy	Combination of both vaccination and immunoglobulin. This treatment interrupts vertical transmission in 85% to 90% of cases	None available	Consultation with infectious disease and obstetric specialists because of the potential risks of drug toxicity