

# WOMEN'S HEALTH CONSIDERATIONS FOR EXPLORATION SPACEFLIGHT

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# WOMEN'S HEALTH CONSIDERATIONS

## OUTLINE

- ▶ ABNORMAL UTERINE BLEEDING
- ▶ ANEMIA
- ▶ BONE MINERAL DENSITY
- ▶ OVARIAN CYSTS
- ▶ VENOUS THROMBOEMBOLISM
- ▶ CONTRACEPTION
- ▶ FERTILITY
- ▶ HEALTH MAINTENANCE



# ABNORMAL UTERINE BLEEDING

## BACKGROUND

- ▶ Affects 14-25% of reproductive-aged women in the US
- ▶ Etiology can be structural and non-structural
  - ▶ **PALM**: polyps, adenomyosis, leiomyomas, malignancy/neoplasia
  - ▶ **COEIN**: coagulopathy, ovulatory dysfunction, endometrial disorders, iatrogenic, not otherwise classified
- ▶ Unknown how the space environment affects AUB
  - ▶ Simulated microgravity (hind-limb unloading) affects estrous cycling
  - ▶ Bed rest studies have not affected the menstrual cycle



# ABNORMAL UTERINE BLEEDING

## PRE-FLIGHT CONSIDERATIONS - STRUCTURAL

- ▶ Pre-flight TVUS (transvaginal US) recommended for all female astronauts with AUB
- ▶ Can consider diagnostic ± therapeutic hysteroscopy if any concern for endometrial or intramural pathology
  - ▶ If polyp → polypectomy → LNG IUD
  - ▶ If adenomyosis → LNG IUD vs. hysterectomy
  - ▶ If leiomyomas → myomectomy → LNG IUD
  - ▶ If malignancy/neoplasia → mgmt depends upon pathology



# ABNORMAL UTERINE BLEEDING

## PRE-FLIGHT CONSIDERATIONS – NON-STRUCTURAL

- ▶ Screening for PCOS, thyroid dysfunction, prolactinoma
- ▶ Screening for personal/family history of bleeding disorders
- ▶ Screening and treatment of iron deficiency
- ▶ Management of non-structural AUB:
  - ▶ Progesterone-only or progesterone/estrogen therapy
  - ▶ LNG IUDs are first line agents for treating new-onset AUB and preventing recurrence
- ▶ Screening for inherited thrombophilias



# ABNORMAL UTERINE BLEEDING

## PRE-FLIGHT CONSIDERATIONS – MENSTRUAL SUPPRESSION

- ▶ Combined Hormonal Contraceptives (CHCs) and LNG-IUD achieve highest rates of amenorrhea
  - ▶ LNG-IUD:
    - ▶ no risks/side effects of systemic estrogen
    - ▶ Remains efficacious for 5-7 years
    - ▶ Function is not dependent upon strict daily compliance
  - ▶ CHCs:
    - ▶ May be associated with less BMD loss
    - ▶ Can suppress ovarian cyst formation
    - ▶ Avoids IUD-associated migratory risks
    - ▶ More cumulative spaceflight experience



# ABNORMAL UTERINE BLEEDING

## IN-FLIGHT CONSIDERATIONS

- ▶ No perfect modality of inducing amenorrhea or preventing AUB in-flight
- ▶ Advanced surgical options likely unavailable → pharmacologic management = mainstay of treatment
- ▶ CMOs should have some pre-flight training in digital pelvic examination
- ▶ Speculums are not currently available
- ▶ Point-of-care lab tests may include CBC, pregnancy test
- ▶ TAUS (TVUS if available)

# ABNORMAL UTERINE BLEEDING

## IN-FLIGHT CONSIDERATIONS

- ▶ New-onset AUB in-flight:
  - ▶ Continue LNG-IUD or current CHC
  - ▶ Consider adding a burst taper of CHCs
  - ▶ GnRH agonists/antagonists
- ▶ Non-hormonal pharmaceuticals that can be considered include:
  - ▶ TXA: prevents fibrin/clot degradation w/o increasing VTE risk
  - ▶ NSAIDs: shown to decrease duration and volume of menses
  - ▶ Doxycycline: low risk adjunctive medication to hormonal modalities
- ▶ Extreme scenarios



# BONE MINERAL DENSITY

## PRE-FLIGHT/IN-FLIGHT CONSIDERATIONS

- ▶ Estrogen
  - ▶ Shown to be protective against cortical / cancellous BMD loss in microgravity analogs and spaceflight
  - ▶ Evidence is inconclusive for LNG-IUD
- ▶ Recommend vitamin D and calcium supplementation
- ▶ Recommend resistive exercise
- ▶ May consider bisphosphonate

# OVARIAN CYSTS

## PRE-FLIGHT CONSIDERATIONS

- ▶ Ovarian cyst production is common following ovulation
  - ▶ Present in 5-7% of reproductive-aged females
  - ▶ Most will resolve spontaneously
  - ▶ Theoretically, large cysts can prompt ovarian torsion
- ▶ Pre-flight management of cyst:
  - ▶ Observation vs. laparoscopic management for simple cysts
  - ▶ Work-up for malignancy if concern



# OVARIAN CYSTS

## IN-FLIGHT CONSIDERATIONS

- ▶ Acute abdominopelvic pain during flight:
  - ▶ Consider torsion
  - ▶ TAUS (or TVUS if available) may be diagnostic
- ▶ Management of Torsion:
  - ▶ Terrestrially: surgical emergency for preservation of ovarian tissue and prevention of rare but severe morbidities
  - ▶ In-flight management: conservative measures including of pain control and management of sequelae
    - ▶ Long term risks likely low

# VENOUS THROMBOEMBOLISM

## PRE-FLIGHT/IN-FLIGHT CONSIDERATIONS

- ▶ Risk factors during flight
  - ▶ Microgravity: relative lower limb immobility
  - ▶ Altered hydration status and fluid distribution – increased upper extremity congestion, potential for VTE
  - ▶ Exogenous hormone use
    - ▶ Cyclical use of estrogen is associated with 4-6X risk of VTE
    - ▶ Unclear risk profile with continuous suppression
- ▶ Recently reported sentinel event of VTE during flight (Marshall-Goebel 2019)
  - ▶ In-flight management of VTE is a subject of current discussion in operational medical group



# ENDOMETRIOSIS

## PRE-FLIGHT/IN-FLIGHT CONSIDERATIONS

- ▶ Endometriosis affects 10% of reproductive-aged women
- ▶ Gold standard diagnosis: Laparoscopy
- ▶ Therapeutic options:
  - ▶ Continuous CHCs
  - ▶ High-dose progestins
  - ▶ GnRH agonists/antagonists with add-back estrogen

# HEALTH MAINTENANCE

## PRE-FLIGHT/IN-FLIGHT CONSIDERATIONS

- ▶ Screening for STIs / Pap Smear within 12 months of flight
  - ▶ Chlamydia, Gonorrhea, Trichomonas, Syphilis, HSV, HIV, HPV
- ▶ HSV suppression during flight if affected, consider prophylaxis?
- ▶ HPV vaccine encouraged for all astronauts
  - ▶ Early colposcopic management if necessary



# HEALTH MAINTENANCE

## PRE-FLIGHT/IN-FLIGHT CONSIDERATIONS

- ▶ Screening for peri-menopausal symptoms, urogynecologic symptoms, vulvar/vaginal dermatoses prior to flight
- ▶ Screening for family history of gynecologic/breast cancers as well as familial cancer syndromes (i.e BRCA, HNPCC, Cowden's)
- ▶ Annual clinical breast exams
- ▶ Diagnostic mammograms ± US/MRI PRN starting at age 35



# PREGNANCY / FERTILITY

## PRE-FLIGHT-POST-FLIGHT CONSIDERATIONS

- ▶ Routine pregnancy testing with final pre-flight pregnancy test performed ~10 days prior to flight
- ▶ Discuss fertility desires and timing before mission assignment
  - ▶ Discuss age-related risks associated with advanced maternal age if delaying parity
  - ▶ Fertility outcomes have not been robustly studied post-flight
  - ▶ Consider assessment of ovarian reserve and oocyte/embryo banking
- ▶ Discuss contraceptive modalities, the risk of pregnancy in-flight is  $> 0\%$



# AREAS OF INTEREST

## PRE-FLIGHT-POST-FLIGHT CONSIDERATIONS

- ▶ Long-duration spaceflight will introduce continued and novel challenges for maintenance of gynecological and reproductive health
- ▶ The impact of the space environment outside of LEO of women's health remains unknown
- ▶ There is a driving need for increased data collection and analysis to properly characterize and mitigate women's health risks in future spaceflight

# IMPORTANT LINKS / REFERENCES

Steller et al 2020

Marshall-Goebel 2019

Blue 2019