Venous Thromboembolism Prophylaxis in Morbidly Obese Critically Ill Patients

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Background/Significance

- Enoxaparin:
  - Commonly used in ICU to prevent venous thromboembolism (VTE; including pulmonary embolism and deep venous thromboembolism), especially during immobilization periods.
  - Recommended enoxaparin dose:
    - 40 mg SQ daily for patients with CrCl ≥ 30 ml/min
    - 30 mg SQ daily for patients with CrCl < 30 ml/min.
- Obesity as well as ICU admission: increase risk of VTE
- Previous studies in obese patients: evaluated weigh based dosing strategies in medically or surgically ill or trauma patients
  - Bickford et al[1] (2013, n=86): 0.5 mg/kg q12h in Trauma obese patients, 86% of patients achieved target anti-Xa levels.
  - Freeman et al[2] (2012, n=31): 40 mg vs. 0.4 or 0.5 mg/kg q24h in medically ill morbidly obese patients, 40 mg: < 20%, 0.4 mg/kg q24h: < 40%, 0/5 mg/kg q24h: >80%of patients achieved target anti-Xa levels.
  - Ludwig et al[3] (2011, n=23): 0.5 mg/kg q12h in surgically obese ICU patients, 91% of patients achieved target anti-Xa levels.
  - Rondina et al[4] (2009, n=28): 0.5 mg/kg q24h in medically ill obese patients. Average peak anti-Xa level: 0.25 units/ml.
- Limitations of previous studies
  - Various dosing strategies
  - Outcome: anti-Xa levels rather than clinical outcomes (i.e.; VTE rate)
  - No control group, not randomized.
- Current clinical practice in my institution:
  - Not adapted a weight-based dosing scheme in ICU
  - Need the evaluation of fixed dose schemes

Hypothesis

- Use of a standard enoxaparin VTE prophylactic dose is associated with a higher prevalence of VTE in morbidly obese critically ill patients compared with patients with normal body weight during inpatient enoxaparin prophylaxis therapy.

Aims

- Aim 1: Compare the prevalence of VTE during inpatient enoxaparin prophylaxis therapy between non-morbidly obese patients (BMI <40 kg/m^2) and morbidly obese patients (BMI ≥ 40 kg/m^2) who received standard DVT prophylactic dose of enoxaparin in ICU.
- Aim 2: Assess the extent of the relationship between average enoxaparin daily dose/kg (mg/kg/day) and time to develop VTE (days).

Methods

Study design

- This is a retrospective cohort study which will conduct medication chart review through ICU database (MIMIC II) between 2001 and 2008.
- The Multiparameter Intelligent Monitoring in Intensive Care II (MIMIC II) data base (http://physionet.org/mimic2)[5]
  - Public research archive of data collected from patients in ICUs in a tertiary teaching hospital
  - Query Builder web-based tool
  - Available data: patient demographic information, ICD-9 code, admission date, discharge date, death date, physiologic data, lab results, medications, fluid balance, notes and reports, etc.
  - Validated in various clinical trials.[6-9]
  - IT support is needed to get the data from MIMIC II database: Programming language: Java, SQL

Inclusion criteria

- ICU patients, age ≥ 18 years
- Received at least three standard dose of enoxaparin (40 mg SQ daily or 30 mg SQ bid for CrCl >30 ml/min; 30 mg SQ daily for CrCl < 30 ml/min) for VTE prophylaxis in ICU

Exclusion criteria

- Received non-standard dose of enoxaparin or had a missing dose of enoxaparin
- No weight or height information
- No VTE risk factors
- Received concomitant other anticoagulant therapy (ex: warfarin)

Study groups

- Control group: BMI < 40 kg/m^2
- Experimental group: BMI ≥ 40 kg/m^2

Outcomes measures

- *Primary outcome*: VTE rate during hospitalization
  VTE should be confirmed by ICD9 code or diagnostic test results
- *Secondary outcomes:*
  - Average daily dose per weight, total enoxaparin dose
  - Total duration of therapy, hospital length of stay, ICU length of stay
  - Time to onset of VTE during hospitalization
  - Bleeding incidence

Sample size

- Alpha: 0.05, power 80%, expected rate of VTE in patients with BMI ≥ 40 (10%), expected rate of VTE in patients with BMI <40 (5%), required sample size per group -----434 patients/group

Results

- IRB approval is not required since this study uses a publically available database. (verified this with Texas Tech University Health Sciences Center IRB)
- MiMIC II clinical database access was obtained.
- Currently working on getting collaborative research from the computer science department at Texas tech University.

Conclusion

- Study results will reveal if VTE rate is different in morbidly obese patients.
- The study results will provide a foundation for subsequent research that compares different dosing strategies in critically ill morbidly obese patients to identify optimal VTE prophylactic dosing.

References

Available upon request