with once-daily dosing, suggesting that once-daily dosing is appropriate in patients with severe renal impairment.[93] Although trough levels may be more indicative of accumulation of anti-Xa activity, their clinical significance is not yet clear and needs further investigation.

Recommendations for Laboratory Monitoring of LMWHs

1. Monitoring of anti-Xa levels is not needed in clinically stable or uncomplicated patients treated with LMWH.[95]
2. Laboratory monitoring of the anticoagulant effect of LMWH may be considered in patients with morbid obesity, severe renal impairment, pregnancy, pediatrics, and unexpected thromboembolic complications.[93-95] The usefulness of laboratory monitoring is undetermined in patients undergoing renal replacement therapy.
3. There is no clear consensus on the therapeutic range for anti-Xa activity in patients receiving prophylactic or treatment doses of LMWH for either venous or ACS indications. We suggest that generally, peak concentrations of 0.2–0.4 IU/mL for VTE prophylaxis, 0.5–1.0 IU/mL for VTE treatment with twice-daily dosing regimens and 1.0–2.0 IU/ml with once-daily dosing regimens, and 0.5–1.5 IU/mL for use in ACS should be the targets.[a]
4. Peak anti-Xa levels should be drawn 4 hours following subcutaneous injection.[94,112-115]
5. Trough anti-Xa monitoring may be used to evaluate accumulation at the end of the dosing interval in patients with renal impairment.[93,a]
6. Anti-Xa activity should be determined using a chromogenic method and a calibration curve based on the LMWH used.[94,102,103]
7. Once anti-Xa levels are obtained, there is no recommended method for adjusting doses to achieve a desired anti-Xa concentration. We suggest that the nomogram in Table 8 be applied for treatment doses of LMWH.[2,117,a]

[a]This recommendation is based on the authors' experience and clinical practice, because published data to support this recommendation are lacking.

Summary

Information on the use of LMWHs in patients with impaired renal function or obesity is incomplete. Available studies vary in methodology and outcomes, which complicates their interpretation. Clinical practice recommendations were lacking for these patients and clinical practice is highly inconsistent. Based on available information, we have formulated practical recommendations for dosing and monitoring of LMWH in these specific subpopulations (Table 1). Recommendations based on our experience and clinical practice remain to be confirmed in well-designed studies. These clinical practice recommendations may aid clinicians in the use of LMWHs in these difficult-to-manage patient populations.

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*Only to be used for Q 12 hour dosing; use clinical judgment for once daily dosing

Table 8. Sample LMWH Dosing Nomogram for Treatment Doses of Enoxaparin

Anti-Xa Level (U/mL)	Hold Next Dose	Dosage Change	Next Anti-Xa Level
<0.35	no	increase by 25%	4 h after next dose
0.35–0.49	no	increase by 10%	4 h after next dose
0.5–1.0	no	no	next day, then in 1 wk, then monthly
1.1–1.5	no	decrease by 20%	before next dose
1.6–2.0	3 h	decrease by 30%	before next dose and 4 h after next dose
>2.0	until anti-Xa <0.5 U/mL	decrease by 40%	before next dose and q12h until anti-Xa <0.5 U/mL

LMWH = low-molecular-weight heparin.
Reproduced from Monagle et al. *Chest* 2001;119(suppl 1):344-70, with permission from the American College of Chest Physicians,[117] adapted according to Nutescu et al.[2]