



## **Nursing Skill and Responsibility in Administration of Low Molecular Weight Heparin by Prefilled Syringe**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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**Short Communication**

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### **ABSTRACT**

**Abstract:** Low-molecular-weight heparins (LMWHs) have proven to be effective in the prevention and treatment of thrombotic disorders, as well as substitute for unfractionated heparin (UFH). LMWHs are a diverse collection of medicines with different biochemical and pharmacological characteristics, despite the fact that they all have antithrombotic actions. Medicine is administered into the subcutaneous tissues with these injections. Small amounts of injections are delivered by the subcutaneous approach, which involves inserting a small thin needle beneath the skin and slowly injecting the medicine. Low molecular weight heparins make up dalteparin and enoxaparin, two anticoagulants. The rights of medicine administration must be followed by nurses. For patients on LMWH medication, the most essential blood test is prothrombin time. Following administration, look for any signs of bleeding, such as occult blood in the stool, malena, bleeding gums, and skin discoloration/hematoma. The antidote for low molecular weight heparin is protamine sulphate. It is effective at counteracting the effects of LMWH. 100 units of LMWH are neutralised by 1 mg of protamine sulphate. If it's been more than 8 hours since you've given LMWH, provide 0.5 mg protamin per 100 units of LMWH.

**Keywords:** Bleeding; LMWH; Malena; medication administration; protamine sulfate.

## 1. INTRODUCTION

Medicine is administered into the subcutaneous tissues using these injections. Small quantities of injections are administered by the subcutaneous technique, which involves inserting a small thin needle beneath the skin and slowly injecting the medicine. The medication is absorbed into the bloodstream through small blood vessels. Subcutaneous injections are most commonly administered to the belly, upper back, or upper leg [1].

Low molecular weight heparin is generated from unfractionated heparin by chemical or enzymatic digestion or depolymerization of larger chains of heparin into shorter chains [2].

Low molecular weight heparins are used to make the anticoagulants dalteparin and enoxaparin. These drugs are used to treat deep vein thrombosis (DVT) and pulmonary embolism, as well as to prevent venous thromboembolic disease while in the hospital [3].

### 1.1 Indications

The molecular weight is quite low. Heparin is given to patients who are admitted to the hospital for an emergency or elective purpose to treat deep vein thrombosis and pulmonary embolism, as well as to prevent venous thromboembolic illness [5].

1. DVT prophylaxis for people at medium and high risk (surgical, orthopaedic and medical patients) [6].

2. To treat venous thromboembolism in pregnant women.
3. DVT and PE treatment in non-pregnant women (those with both high and low risk of recurrence)
4. It is used in the treatment of non ST elevation Myocardial infraction. (in both those undergoing percutaneous coronary intervention and those not)
5. Angina pectoris instable
6. Clotting prevention in extracorporeal circuits
7. Primary prevention in patients who are having a lower limb amputation [7].
8. To avoid venous thrombosis in adult arthroscopy patients [8].
9. For the special population
  - a. prevention Of clotting during dialysis and surgical procedure.
  - b. Bridging during temporary warfarin interruption.
  - c. Arterial fibrillation, anterior wall myocardial infraction.
  - d. Systemic arterial embolism
  - e. Selected stroke syndrome.
  - f. Cervical artery dissection.
  - g. Anticoagulation in patient with renal insufficiency [9].

Because LMWHs aren't the only anticoagulants used for these objectives, a thorough understanding of the many anticoagulants on the market, as well as their benefits are essential for a suitable prescription.

**Table 1. Pharmacological Properties Of Low Molecular Weight Heparin [4]**

	<b>Enoxaparin</b>	<b>Delteparin</b>	<b>Tinzaparin</b>
Brand Name	Lovenos	Fragmin	Innohep
Manufacturer	Sanofi-Aventis	Pfizer (For Eisai)	Leo (Formerly Dupont)
Manufacturing Process	Benzylation Followed By Alkaline Hydrolysis	Controlled Nitrous Aciddepolymerization	HeparinaseDigestion
Mean Molecular Weight (Daltons)	4,500	6,000	6,500
Elimination Half Life (Hours)	4.5	3.5	3.4
Bioavailability (%)	90-92	87	87
Anti-Xa/anti-II ratio	3.8	2.7	2.8
<i>Anti-Xa activity (IU/mg)</i>	100	156	100

\* Xa = Coagulation factor Xa is a protein that reverses the effects of certain anticoagulant medications that are used to treat or prevent blood clots.

## 2. CONTRAINDICATIONS FOR LMWH

Before initiating prophylaxis, all patients should be evaluated for contraindications and necessary precautions. Hypersensitivity, prior or present heparin-induced thrombocytopenia, and ongoing bleeding are all absolute contraindications to heparin [10].

All patients should be examined for contraindications and required precautions before starting prophylaxis. Heparin is absolutely contraindicated in cases of hypersensitivity, past or current heparin-induced thrombocytopenia, and continuing bleeding.

- If the patient has a bleeding problem, such as haemophilia.
- Use of certain medications at the same time, such as clopidogrel.
- Conditions in which a large amount of blood would be fatal. For example, a localised lesion or a hemorrhagic stroke.
- Creatinine clearance <30ml/min [11].
- High risk of uncontrollable bleeding, such as acute ulcerative gastrointestinal disorders, unclear aetiology anaemia
- Recent history of eye, brain or spinal cord injury.

- Thrombocytopenia at a high degree (platelets <  $\times 10^9/L$ )
- The symptoms of severe liver disease include coagulopathy and/or oesophageal varices [12].
- Needle insertion in the spine or epidural space (spinal tap or spinal anaesthesia).

### 2.1 Sites for Administration of LMWH

1. The abdomen area is the most popular injection site. The umbilicus must be 2 inches away from the injection site (see diagram). Low molecular weight Heparin can also be injected into thigh thighs or buttocks.
- Injection locations should be rotated. A bruised region should not be injected.
  - If there is bruising at the site of injection use ice or cold fomentation on the bruised area.
  - If any surgical procedure is planned inform to clinician.
  - Inform to physician if there is blood in urine, stool or gum bleeding lasting for more than 15 minutes [13].



Fig.1. Administration of LMWH

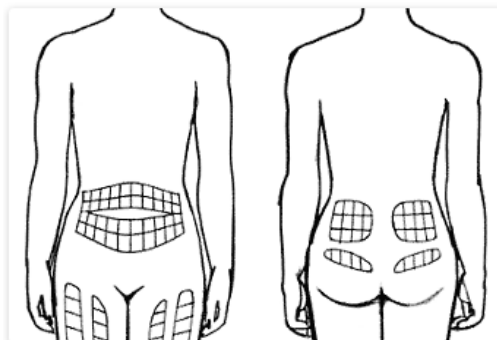


Fig. 2. Sites for administration of LMWH

## 2.2 Mode of Action

Anticoagulants, such as LMWHs, work by blocking the coagulation cascade's final common pathway. The purpose of the coagulation cascade is to turn fluid blood into a clot, which prevents bleeding. The conversion of fibrinogen to fibrin by thrombin activity is the final common route. Antithrombin III is activated by LMWH, which reduces coagulation. Factor Xa is binded by antithrombin III, which suppresses it. It does so by preventing activation of the final common route; Xa inactivation implies that prothrombin is not converted to thrombin, and so fibrinogen is not converted into fibrin for clotting. LMHW is a

small fragment of a larger mucopolysaccharide, heparin [7]. Antithrombin III is activated when heparin binds to it. Heparin also has a thrombin binding site that allows thrombin to interact with antithrombin III and heparin to avoid blood clotting. Because it inhibits both Xa and thrombin, heparin has a faster start of anticoagulant effect than LMWH [7].

Antidote: Protamine neutralises the antithrombin activity of LMWHs, resulting in normalisation of the aPTT and thrombin time, according to animal and in vitro investigations. The anti-factor Xa activity of LMWH appears to be largely neutralised by protamine [14].

**Table 2. Nursing procedure for the administration of lmwh [15]**

S/NO	Nursing actions	Rationales
1	Review the medication order and confirm identity of patient	To prevent errors during administration.
2	Gather equipment and explain the procedure to the patient.	To ensure accuracy during drug administration.
3	Wash hands and done gloves.	To prevent spread of microorganism
4	Provide privacy and select appropriate site for subcutaneous injection.	To facilitate consistent absorption of medication.
5	Provide proper position according to the site selected. (sitting or supine)	Ensures free access to injection.
6	Using the alcohol swab, clean the injection site in a circular motion, starting at the site and working outward. Grasp the region around the injection site and pinch it, or spread the skin at the injection site.	Removes surface contaminants and bacteria. A circular motion pushes microorganisms away from the selected site.
7	Remove the needle shield from the safety syringe by pulling it straight off. Don't let the air bubble escape [10].	While administering LMWH air bubble remains at the top and prevent the skin discoloration. The air bubble helps to trap the medication in the subcutaneous layer, thus preventing the medication to leak to the epidermis layer. This helps to prevent severe bruising on the skin and keeps the medication where it is supposed to stay.
8	Hold the syringe bevel upward between the thumbs and forefingers of dominant hand insert the needle using 45-90° angle. Most patients have enough subcutaneous tissues to insert syringe at 90° angle, very thin patient may require 45°angle	Subcutaneous tissue is abundant in well-nourished and less in thin patient. Angle of needle is changed for thin patient to prevent injection into the muscle and artery.
9	Slowly inject the solution.	Rapid injection may cause tissue distention and discomfort.
10	Release the tissue after drug injection and switch your non-dominant hand to the syringe's plunger end.	Non dominant hand secures the needle and allow for smooth aspiration.
11	Remove the needle and do not massage the site with an alcohol swab. If blood appears on site, cover the site with alcohol swab	Massaging the site spread the medication and induration site.
12	Do not recap the needle, discard directly into the receptacle.	To prevent needle stick injuries.
13	Ensure patient comfort, wash hands and record medication.	To promote comfort and prevent legal issues.

## 2.3 LMWH Injection Do's and Dont's [16]

### 2.3.1 DO'S

1. Examine the patient for any drug-drug interactions as well as any contraindications, drugs, or procedures that may enhance the risk of haemorrhage.
2. Double-check the order. Examine the most recent lab results for the patient, particularly the total blood count and platelet count. Take a look at how you've used your medications in the past.
3. Always use aseptic approach. Determine the patient's condition before preparing the drug.
4. Inform the patient about the procedure and ensure privacy.
5. Wear the gloves and choose the injection site on the abdominal wall, alternating sides.
6. Remove the needle shield from the safety syringe without releasing any air.
7. Encourage the patient to unwind and take a few deep breaths. Inform the client that they might experience some burning.
8. After cleaning the injection site with alcohol dry it; a moist site can cause further stinging.
9. Using your finger, grasp the skin fold and inject the drug into it. This activity aids in ensuring that the drug only reaches adipose tissue and not muscle. Every day, switch the LMWH injection locations.
10. Every day, inject LMWH at the same time.
11. Use a sharps collector to dispose of the syringe after use.
12. Keep an eye out for unusual bleeding indicators.

### 2.3.2 DONT'S

1. Do not touch the needle or syringe anywhere, to ensure aseptic technique.
2. Do not screw off the needle cap; this may cause the needle to bend.
3. Do not inject LMWH if there is scare or bruising, or any other site where friction can occur.
4. Do not massage the injection site afterward, since this may cause bleeding in tissue.
5. Do not aspirate the syringe during injection delivery.

6. Don't recap the needle.
7. Do not freeze the LMWH; room temperature is convenient for storing it.
8. Don't give LMWH to anyone other than the person it was prescribed for.
9. Do not give any other medication with LMWH which increases the risk of bleeding.
  - Any product containing aspirin or equivalent medicine.
  - Platelet inhibiting agents like clopidogrel
  - Nonsteroidal anti-inflammatory medicines (NSAIDs) are medications that are used to treat inflammation (NSAIDs). Products containing any of these medications, such as cold or allergy remedies or pain relievers [17].

## 2.4 Antidote of Low Molecular Weight Heparin

The antidote for low molecular weight heparin is protamine sulphate. It is effective at counteracting the effects of LMWH. 100 units of LMWH are neutralized by 1 mg of protamine sulphate. If it's been more than 8 hours since you've given LMWH, provide 0.5 mg protamin per 100 units of LMWH [18].

### ❖ NURSING FOCUS ON LOW MOLECULAR WEIGHT HEPARIN THERAPY

## 2.5 Assessment of the Client

Throughout the LMWH administration procedure, Nurses needs to follow the rights of medication administration and the high risk drug policy:

- Obtain complete health history including allergies, drug history and possible drug interactions.
- Assess baseline coagulation studies and complete blood count.
- Assess for history of bleeding disorders, Gastrointestinal bleeding, cerebral bleed, recent trauma
- Obtain patient's drug history including use of over the counter medications that might affect coagulation and assess allergies.
- Prefilled syringe of the LMWH must be double checked with the ward sister incharge or the medical officer on duty, or the senior registered nurse. Nurse.
- Assess for history of alcohol abuse.

**Table 3. Implementation**

<b>Intervention</b>	<b>Patient Education</b>
Monitor for bleeding. Check color of urine, occult blood in stool, and/or changes in vital signs. (Patients with history of peptic ulcer disease, alcoholism, kidney or liver disease, and the elderly are at greatest risk for bleeding) Follow the safe injection practices.	Advise patient to: <ul style="list-style-type: none"> <li>• Use a soft toothbrush and an electric shaver.</li> <li>• Avoid all contact sports while on heparin therapy.</li> <li>• Report even minor injuries to the health care provider</li> <li>• Wear identification stating patient is on anticoagulant therapy if they are receiving subcutaneous heparin outside the hospital setting</li> </ul>
Check for the lab values of PT, APTT and INR	Inform the client and family members that these tests are required in order to determine the coagulant profile's baseline value.
Smoking cessation should be encouraged. (Nicotine inhibits heparin's action.) While using heparin, the patient should not smoke.)	While on heparin therapy, advise the patient to avoid tobacco.
If a woman is menstruation, keep an eye on her CBC. (Anticoagulants might induce heavy bleeding during menstruation.)	Inform the patient that heparin may cause increased menstrual bleeding and that any abnormal bleeding should be reported to their health care provider.

*Key \*PT= prothrombin time, APTT = Activated Partial Thromboplastin Time (APTT) AND INR STANDS FOR = International Normalized Ratio (INR)*

## 2.6 Potential Nursing Diagnosis

Risk for bleeding related to side effects of anticoagulant medication.

## 2.7 Patient Goal and Expected Output

The patient will remain free of unusual bleeding.

## 3. EVALUATION OF OUTCOME

Evaluate effectiveness of drug therapy by confirming that the patient goals and expected outcomes have been met.

## 4. CONCLUSION

Low-molecular-weight heparins (LMWHs) have long been used to prevent and treat thrombotic disorders, as well as to replace unfractionated heparin (UFH). LMWHs are a diverse collection of medicines with different biochemical and pharmacological characteristics, despite the fact that they all have antithrombotic actions. Medicine is administered into the subcutaneous tissues with these injections. Small amounts of injections are delivered by the subcutaneous approach, which involves inserting a small thin needle beneath the skin and slowly injecting the medicine. The anticoagulants dalteparin and enoxaparin are composed up of low molecular weight heparins. Nurses must adhere to medication administration rights. For a patient on

LMWH medication, the most essential blood test is prothrombin time. After administration, look for any signs of bleeding, such as occult blood in the stool, malena, bleeding gums, and skin discoloration/hematoma. The antidote for low molecular weight heparin is protamine sulphate. It is effective at counteracting the effects of LMWH. 100 units of LMWH are neutralised by 1 mg of protamine sulphate. If it's been more than 8 hours since you've given LMWH, provide 0.5 mg protamin per 100 units of LMWH. This paper describes the precautions for nurses in administering low-molecular-weight heparin. The clinical use of low molecular weight heparin is very important and frequent in the management of thrombotic diseases.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

It is not applicable.

## DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for

any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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