

Investigating the effects of thrombosis

Guide to Week 2 home practical

Note: You will also need to download a copy of the worksheet to fill out during the practical. You can find this in the step named 'Preparing for the thrombosis practical'.

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Introduction

Thrombus formation is part of a normal healthy response to tissue injury to prevent excessive bleeding- you can see this as a scab when you cut yourself, for example.

However, if this process happens inside of the blood vessels it can have detrimental effects, as the thrombus (or clot) may block the flow of blood along a blood vessel.

In a heart attack this may happen if an atherosclerotic plaque in the wall of the small coronary arteries ruptures.

These small blood vessels provide the heart muscle itself with the oxygen and nutrients it needs to contract. If the flow of blood is significantly reduced or

stopped entirely this prevents vital oxygen from reaching parts of the heart and this results in damage to the heart tissue.

Thrombus formation is triggered when the lining of a blood vessel is damaged exposing molecules that are normally hidden from the blood by the endothelium.

Thrombus formation is a multistep process and involves the platelets (tiny anuclear blood cells), and several plasma proteins that form the coagulation cascade.

You will have seen a video demonstration of what happens when human blood clots a step called, 'Demonstration: How the blood clots'. In this exercise you will have a chance to make a jelly cube "thrombus", and investigate the effect of thrombosis.

Learning Objectives

There is more to understanding a topic than just remembering facts. To really understand a topic we first learn the theory then we learn how to apply the theory through practical work.

By the end of this practical you should be able to:

- Understand the effect that a thrombus may have on blood flow.
- Understand that a thrombus can have variable effects.

Assessment

After completing the practical there is a worksheet for you to complete. We will then gather the information from the worksheets as group data and you can post comments about your experience on the discussion boards.

Health and Safety

All of the practicals in this course are optional. Practical work aims to apply the theory already covered, enabling a deeper understanding of the material. If you are unable to, or do not wish to carry out the practicals, it is still recommended that you watch the videos to gain better understanding of the subject, and so that you are able to take part in discussions.

This practical involves working with jelly, balloons, water and a knife. There are several main risks associated with this practical:

- Risk of severe allergic reaction for anyone with a latex or jelly allergy.
- Risk of injury from the knife. Use of knives poses a risk and should only be carried out by competent adults. Those under the age of 18 should be supervised by a parent or guardian.
- Risk of choking on the balloons.
- Risk of slipping and falling on spilt water. Water poses a slip hazard, particularly as this practical has potential to be messy.
- Risk of water damage to your mobile device. Protect your mobile device by placing it inside a clear plastic bag and keeping it away from the immediate work area.

People who may wish to NOT participate in the practical:

- Those with a latex allergy

As for any practical work avoid eating, drinking, chewing gum, chewing pen lids and directly touching your computer or mobile device during the practical.

At the end of the practical, dispose of your waste responsibly. Wash all utensils (knife, pens, plates, trays etc.) with hot soapy water. Wipe down all surfaces with an appropriate disinfectant at the end of the practical.

Finally, wash your hands thoroughly with hot soapy water.

Protecting your mobile device

In addition to protecting yourself it is important that you protect your surroundings and equipment.

If you plan on using a mobile device to follow the practical instructions then we strongly recommend that you place the device inside of a clear plastic bag or wrap it with plastic wrap first (and keep it away from the immediate work area). You may need to try different materials to find one that still lets your device work.

Not only will this protect the device from any small splashes but importantly it protects it from being contaminated by dirty fingers. At the end of the experiment you can simply throw away the wrapping, leaving your device clean and uncontaminated.



What you will need

Before starting this practical make sure that you have the following items on a tray or large plate ready to use:

- Instruction sheet
- Worksheet
- Pen / pencil to write with
- Apron
- Sink area or if not possible access to a tap and use of a washing up bowl or bucket
- Tray, plate or suitable working surface
- Packet of jelly cubes.
- Several standard round balloons
- Knife
- Plate
- Stop clock or clock with second hand
- Sieve or colander
- Access to hot soapy water
- Paper towels or dish cloth
- Suitable disinfectant
- Waste bag

Instructions

Part 1: Video demonstration of thrombus formation

1. Having watched the video demonstration of blood clotting, note any comments on the worksheet relating to:
 - Addition of thrombin to whole blood
 - Addition of thrombin to plasma
 - Addition of thrombin to a platelet suspension

Notice how the addition of thrombin causes blood to turn from a runny liquid to a gel. When you cut yourself this plugs any sites of damage to prevent bleeding, but can also block a blood vessel if there is no external injury.

Part 2: Investigating the effects of thrombosis

1. Work near a sink (with draining board) if possible. If not, you will need access to a tap and a washing up bowl or bucket instead.
2. Check that you have all of your materials, particularly some paper towels/cloths ready to use.
3. Take one standard round balloon and attach it to the tap. Carefully fill it with COLD water until it is about a third of the expected maximum size (hold the balloon to the tap and support it from underneath).



4. Pinch the neck of the balloon and carefully release it from the tap.

5. Hold the balloon over the sink, supporting the balloon from underneath...

Using a clock with a second hand, note the time as you release the neck of the balloon.

Observe what happens and note the time when the balloon is empty (carefully direct the water into the sink!).

Record the time it takes for the balloon to empty on the worksheet. This is your control value.

Repeat twice more to produce three replicates (exact, or close copies).

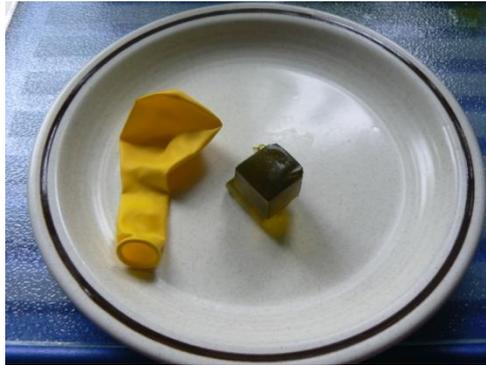
The balloon represents a blood vessel and the water represents the blood flowing inside of it. In healthy individual's the blood flows along the vessels reaching all the tissues downstream, delivering vital oxygen.



6. Open the packet of jelly.



7. Place 1 jelly cube on the plate in front of you.



8. Using the same standard round balloon, use four fingers to hold open the neck of the balloon and partially turn it inside out.



9. Place the open neck of the balloon over the cube of jelly and put the jelly cube inside of the balloon (this may take a couple of tries so you can use your other jelly cubes if you need to).



10. Now attach the balloon to the tap and refill it with approximately the same volume of COLD water. Do not use hot as you will dissolve the jelly cube (hold the balloon to the tap and support it from underneath).



11. Once approximately one third full carefully remove the balloon from the tap by pinching the neck of the balloon as before.

12. Hold the balloon so that the jelly cube falls to the bottom of the balloon.



13. Hold the balloon over the sink supporting it from underneath as before.

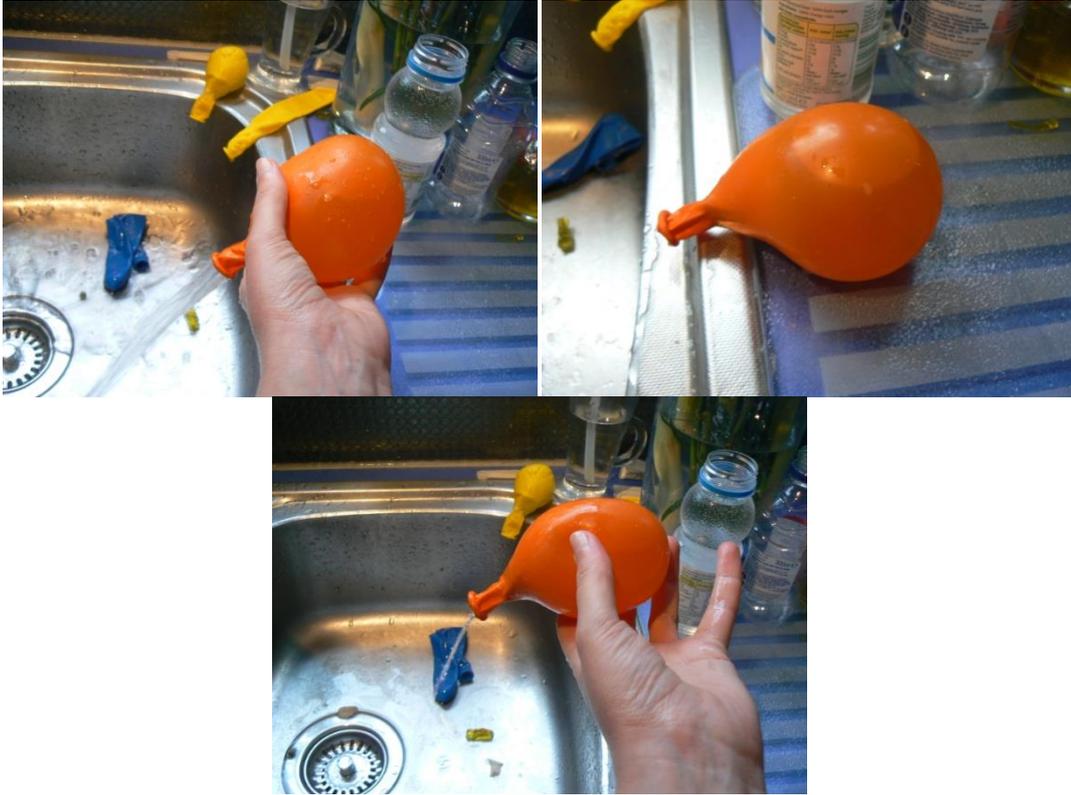
14. Using a clock with a second hand, note the time as you release the neck of the balloon and observe what happens...

Note the time when the balloon is empty. Record this on the worksheet.

If the balloon is still not empty at 1 minute, record this as >60s.

The jelly cube represents a thrombus or clot. The clot may either partially or completely block the flow of blood. If the blood cannot pass the clot the tissues

downstream may become starved of oxygen.



15. Refill the balloon with approximately the same volume of water and repeat the process twice more to produce three replicates, recording each time it takes to empty on your worksheet.

16. Repeat the experiment with a fresh standard round balloon but this time cut the jelly cube in half before placing both halves in the balloon.

Repeat three times, noting the times on the worksheet.

17. Repeat the experiment with a fresh standard round balloon but this time cut the jelly cube into quarters before placing all four pieces in the balloon.

Repeat 3 times, noting the times on the worksheet.

18. Complete the rest of the worksheet.

19. If you wish to you can also explore other variables such as the rate of blood flow...

You could try filling the balloon with more or less water or you could try the experiment with different sized or shaped balloons.

20. Once you have finished clear away.

Dispose of balloons carefully (remember they are a choke hazard for small children or animals).

Wash all utensils with hot soapy water. Clean the work surface with a suitable disinfectant or hot soapy water.

Check that there is no spilt water on the floor that may be a slip hazard to others.

Launder the apron if necessary.

Finally wash your hands with hot soapy water.