

# What was the significance of WWI on Medicine and Surgery?



# 1. New techniques in the treatment of wounds & infection:

One of the main problems facing the RAMC was infections, mostly caused by gas gangrene.

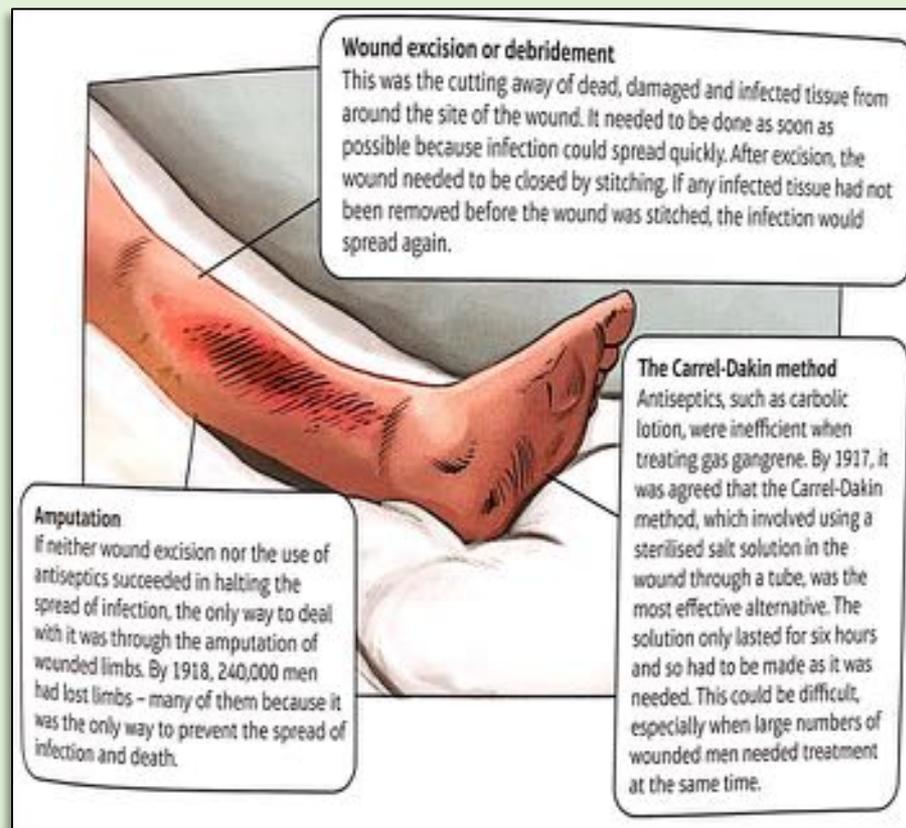
**Do you think aseptic surgery was possible? Why?**

- Contaminated conditions
- Sheer number of wounded men

As a result of this, other methods of treatments were needed. This caused conflict between the medics on the front line and the doctors in Britain



Imagine a soldier has arrived at your ADS with severe infection. There are signs of gas gangrene already... What are your options for his treatment?



Stick your copy of this in to your books and then rewrite a summary in your own words for these techniques / options.

## Source A

From the diary of B. C. Jones, 1915–16. Jones served with the Royal Field Artillery in France from the start of the war until he was wounded in 1915.

7 December. A German shell hit the dugout of our telephone pit. I remembered no more until I woke up in Bethune Casualty Clearing Station Number 33, where I find I have been severely wounded. Left hand blown off, left arm ripped up 12 inches. Scalp wound 6 inches, wound on over side of knee (left) 5 inches.

9 December. Operation on upper arm for gangrene (successful).

12 December. I remain here for 8 days then removed to St Omer by hospital barge, very comfortable. I am then removed by train to Étaples. I am sent to England on the Hospital Ship. Return to Nottingham where I am in bed until the end of February.

3 June 1916. I am eventually transferred to Brighton where I am operated on and re-amputated. Awaiting Roehampton for artificial limb.

## Source B

From Ward Muir's Observations of an Orderly, published in 1917. Muir was a Lance Corporal in the RAMC and worked in a hospital in London that received patients from the Western Front at the end of the chain of evacuation.

The majority of stretcher-cases... reach us in a by no means desperate state, for, as I say, they seldom come to England without having been treated previously at a base abroad (except during the periods of heavy fighting). And it is remarkable how often the patient refuses help in getting off the stretcher on to the bed. He may be a cocoon of bandages, but he will courageously heave himself overboard, from stretcher to bed, with a wallop which would be deemed rash even in a person in perfect health.

### Stick in and study sources A & B:

- What is the **CONTENT** of each source?
- What conclusions can you draw from the fact the soldier in A needed to have a limb re-amputated when he returned home?
- Make a list of inquiries (questions) sources A&B would be useful for answering...

## 2. The Thomas Splint:

In 1914/15, men with a gunshot or shrapnel wound to the leg only had a 20% chance of survival.

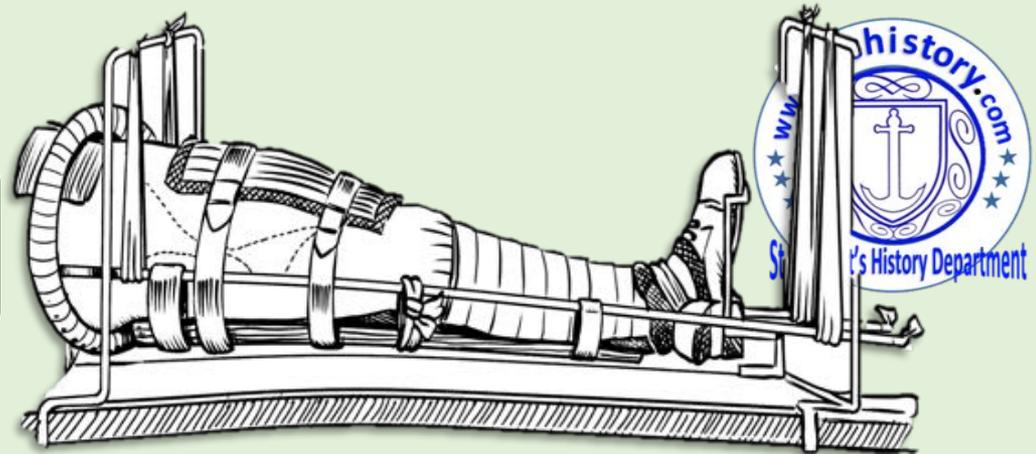
**Why do you think this was?**

- Compound fractures pierced the skin = infection and broken bone inside the leg
- If the femur (thigh bone) was fractured this would lead to massive muscle damage and bleeding into the thigh

The splints they originally used didn't keep the leg rigid so by the time they arrived at the CCS the soldier will have lost a lot of blood, would be in shock and maybe already developing gas gangrene.

Those who survived had their leg amputated at the CCS.

The Thomas Splint was developed in the late 19<sup>th</sup> Century by Hugh Thomas and was designed to stop joints moving



# Survival rates went from 20% to 82%

Do a Thomas Splint on your Features Log

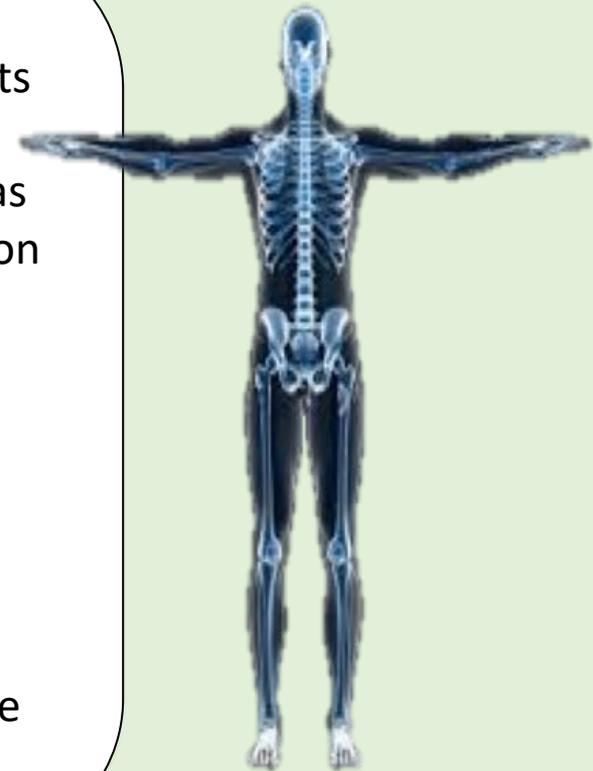
### 3. Mobile X-Rays:



X-Rays were used from the start of the war, mainly to identify shell fragments and bullet wounds that if not removed from the body could cause infection. Two X-Rays were taken from different angles to help the surgeon locate the shrapnel and bullets.

#### Problems with X-Rays on the Western Front:

- X-Rays couldn't detect all objects in the body eg fragments of clothing
- The length of time a wounded man had to remain still was several minutes which could cause problems depending on the wound
- The tubes used in X-Ray machines were fragile and overheated very quickly therefore could only be used for about an hour at a time to then cool down. This was a problem due to the number of wounded soldiers – the solution was to have 3 machines in rotation
- The USA had developed better technology and bulbs but this wasn't available until 1917 when the USA entered the war



The Base Hospitals and some of the larger CCSs had static x-ray machines as part of their equipment. There were **6 mobile x-ray** units operating in the British sector of the Western Front that could be called upon.

### Setting up the mobile unit took some time.

- A tent was attached to the back of the van with a table where stretchers could be placed
- The x-ray machine was placed next to the table **linked to the engine**
- Equipment for processing the x-ray films was set up inside the van
- Quality wasn't as good as the static x-ray but was sufficient in identifying the shrapnel and bullets

Source D

A photograph of a mobile x-ray unit, taken in 1917. Notice how the equipment has been laid out.



How useful is Source D for an enquiry into the use of mobile X-Rays on the Western Front?

Remember – What does it not tell us as well...?

## Source C

**NOP this source**

From *Radiography and Radiotherapeutics*, by Robert Knox, published in 1917. This was a textbook on the use of x-rays written by a British doctor.

The need for portable outfits in connection with the war has led to a great development in the provision of motor wagons containing complete x-ray apparatus with all accessories. The mechanism used for driving the wagon i.e. the motor is coupled with a powerful dynamo which delivers a continuous current.

**How could you follow up Source C to find out more about x-rays on the Western Front?**

**In your answer you must give the question you would ask and the type of source you could use**

### Exam tip

This question involves a four-stage process. The example shows you what to do at each stage.

- **Pick a detail.** For example, 'a great development in the provision of motor wagons.'
- **Question I would ask.** How many x-ray vehicles were used in 1917 on the Western Front?
- **Type of source I would use.** Military records showing the number of x-ray vehicles being used in 1917 on the Western Front.
- **How this might help answer my question.** The data would show whether the numbers increased and quantify the words 'great development' in the statement in Source C..

## 4. Blood (Transfusion & Storage):

What can you remember about blood storage?  
Rewrite this paragraph

So, WWI – Casualty rates were huge, storage of blood was vitally important.

- Sodium \_\_\_\_\_ stopped it \_\_\_\_\_, a citrate \_\_\_\_\_ solution allowed it to be \_\_\_\_\_ for up to 4 weeks, this led to the creation of blood \_\_\_\_\_ by the British.
- \_\_\_\_\_ also discovered how to \_\_\_\_\_ and store crucial blood cells which could then be bottled, packed in \_\_\_\_\_ and used when \_\_\_\_\_ (after a battle), contributing to the growing blood banks.

Citrate

ice

glucose

scientists

Separate

stored

clotting

needed

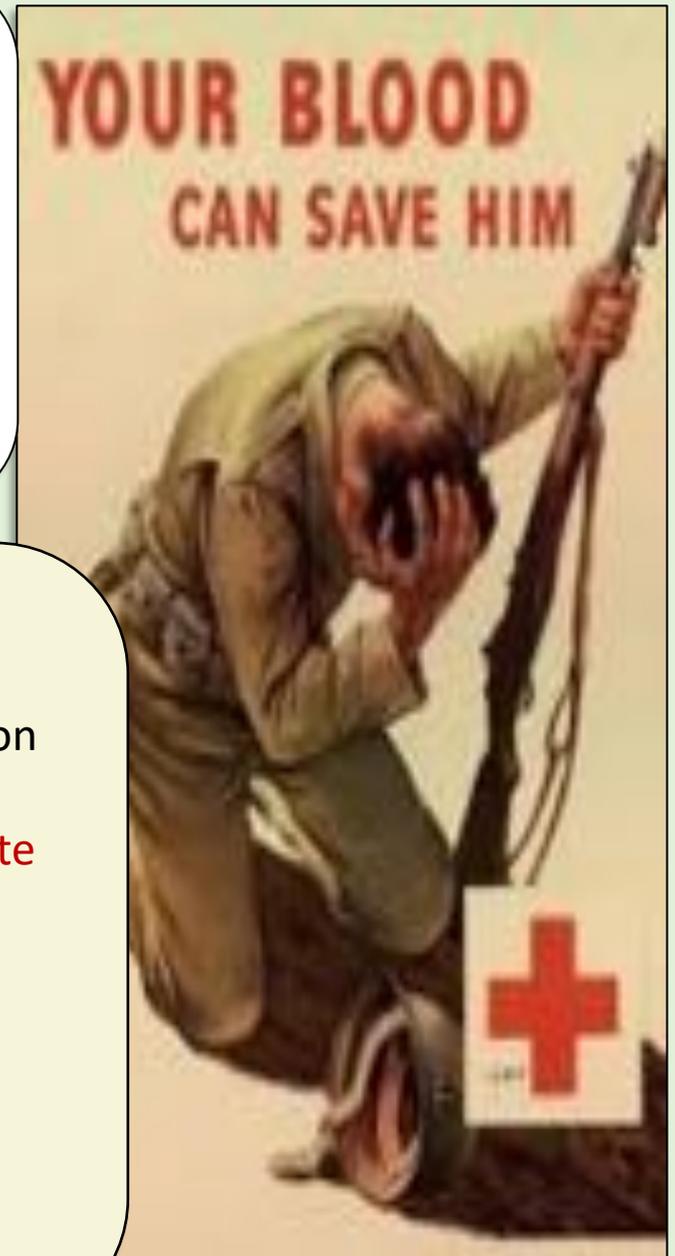
banks



The identification of blood groups and the use of blood type O as a universal donor blood type meant that the risk of being transfused with the wrong blood was reduced. The problem of clotting remained and there was never enough blood to meet demand.

**As the war went on, advances in storage of blood were made:**

- **1915:** American doctor Richard Lewisohn discovered that by adding **SODIUM CITRATE** to blood stopped it from **clotting**, the need for donor-to-donor transfusion was removed
- **1915:** It was discovered that blood with **sodium citrate** could be refrigerated and stored for up to **2 days**
- **1916:** Francis Rous and James Turner found that by adding **citrate glucose** solution to blood, it could be stored for much longer – **up to 4 weeks**.
- When planning a big attack, they could now ask for donations in the weeks before to prepare for the demand!



## 4. Blood (Transfusion & Storage):

- The main work on blood transfusions took place at the Base Hospital in Boulogne.
- As you know, this had been done by syringe and tube from one patient to another which avoided the patient going into shock.
- Due to the relative success of these transfusions, more and more were done at the CCS as routine.

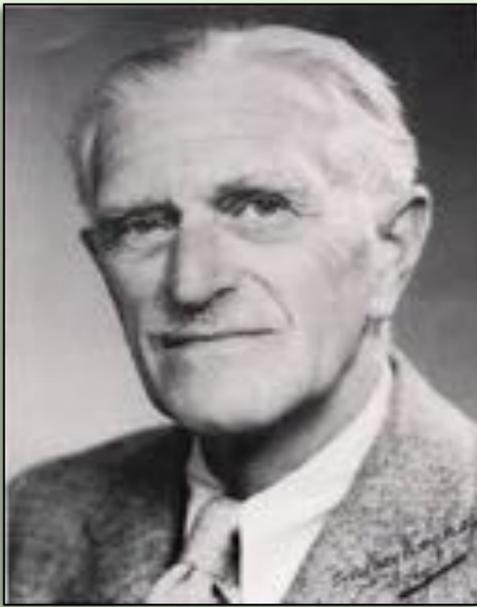


Geoffrey Keynes, a British doctor and lieutenant in the RAMC, designed a portable blood transfusion kit that was used closer to the front line.

**Main problem with Keynes's kit was the lack of refrigeration available so it did not use stored blood.**

**He did however add a device to his blood bottle to regulate the flow which helped prevent it from clotting.**

**What can you remember about blood storage?**



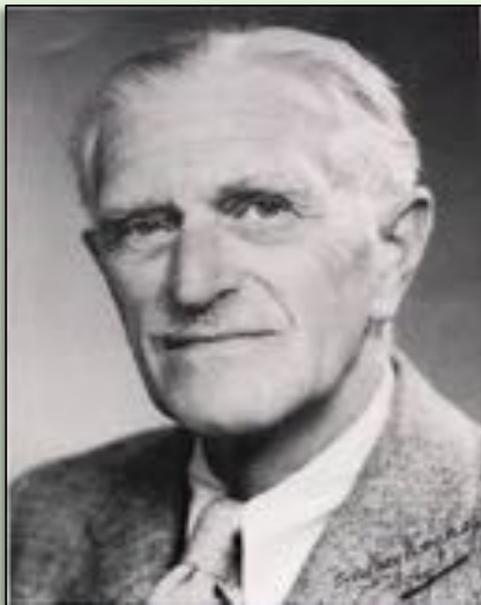
What can you learn about Geoffrey from his Medal card?

Name		Rank	No.
KEYNES		LIEUT	
GEOFFREY LANGDON		Capt.	
Medal	Vol.	Page	Remarks
14 STAR X	C502	58	<i>London &amp; medals mentioned name mentioned in files for p.p. 7th</i>
BRITISH X VICTORY	C291		
GLYS			
EFFICIENCY			
FRANCE 238.14.			

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**An interview with  
Geoffrey Keynes in 1980**

“I spent 2 weeks studying with the Harvard [Blood Transfusion] unit and during that time I contributed something by devising an improved apparatus. I went back to the CCS where I was working and introduced the method there. It saved countless lives of men who would have otherwise died from shock and loss of blood. It provided an incomparable extension to the possibilities of life saving surgery. A preliminary transfusion enabled me to do a major amputation single-handed. A second transfusion then established the patient firmly on the road to recovery that he could be dismissed to the war without any further anxiety”

**NOPCAT this source, remember strengths and weaknesses...**



# The Battle of Cambrai 1917



The use of stored blood was clearly shown in 1917 at the Battle of Cambrai. Before the battle Oswald Hope Robertson stored 22 units of type O (universal) blood in glass bottles stored in ammunition boxes packed with ice and sawdust. He called this a blood depot.

During the battle he treated 20 severely wounded Canadian soldiers with the 22 units of blood, some of which was 26 days old. None of the wounded were expected to survive due to their injuries and going in to shock, of the 20, 11 survived!



This was the first time stored blood was used to treat shock, and although only small scale, it showed its **potential**. The outcome of this was that following Cambrai, only the most severely wounded were taken to the CCS, reducing pressure.

**Write a letter to the Prime Minister explaining the advances in blood storage and the successes from the Battle of Cambrai in 1917.**

**Pay particular attention to the pressure on the CCS from the massive casualties, what might you encourage the Prime Minister to do...?**

# 5. Head injuries and Brain surgery



About 20% of all wounds in the British sector of the Western Front were to the head, face and neck. **WHY?**

**Injuries to the brain were very likely to prove fatal at the start of the war because:**

- The issue of infection applied just as much to the head as other parts of the body
- There were difficulties involved in moving men with head injuries through the chain of evacuation as they were unconscious or confused
- There were very few doctors who had experience of neurosurgery (nervous system, brain & spinal)



Observations quickly led to improvements, Harvey Cushing developed new techniques in brain surgery on the Western Front using Magnets to remove metal fragments. He used local anaesthetics when operating as general anaesthetics made the brain swell. As he observed more, he learned more too. He operated on 45 patients in 1917 with a 71% survival rate.

Brain and head surgery became part of the routine treatments at the larger CCS's as it was noted the sooner treatment was given, the higher the chances of survival. Patients also remained at the CCS for 3 weeks following surgery and all head injuries were carefully examined as it was observed that sometimes fairly minor injuries could be hiding something worse.

## Source E

From *A Surgeon's Journal 1915-18*, by Harvey Cushing, published in 1936. Here he is describing the conditions under which he is working during the battle of Passchendaele on 19 August 1917.

My prize patient, Baker, with the shrapnel ball removed from his brain, after doing well for three days suddenly shot up a temperature to 104 last night about midnight. I took him to the operating theatre, reopened the perfectly healed external wound, and found to my dismay a massive gas infection of the brain. I bribed two orderlies to stay up with him in the operating room, where he could have constant thorough irrigation over the brain and through the track of the missile [passing a warm saline solution along the path taken by the shrapnel to prevent infection]. No light except candles was permitted last night.

NOPCAT Source E, remember strengths and weaknesses..

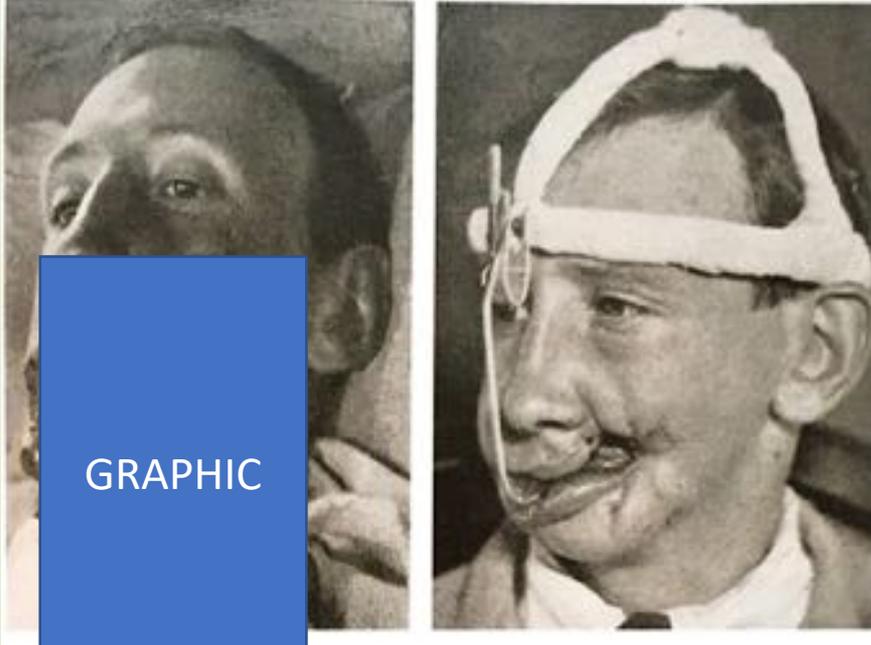
- 1 Why do you think Baker was Cushing's 'prize patient'?
- 2 What happened to make Baker's temperature rise?
- 3 What do you learn about the problems facing surgeons on the Western Front?



# 6. Plastic Surgery

## Source F

Four photographs documenting the facial reconstruction of a soldier whose cheek was extensively wounded during the Battle of the Somme (July 1916).



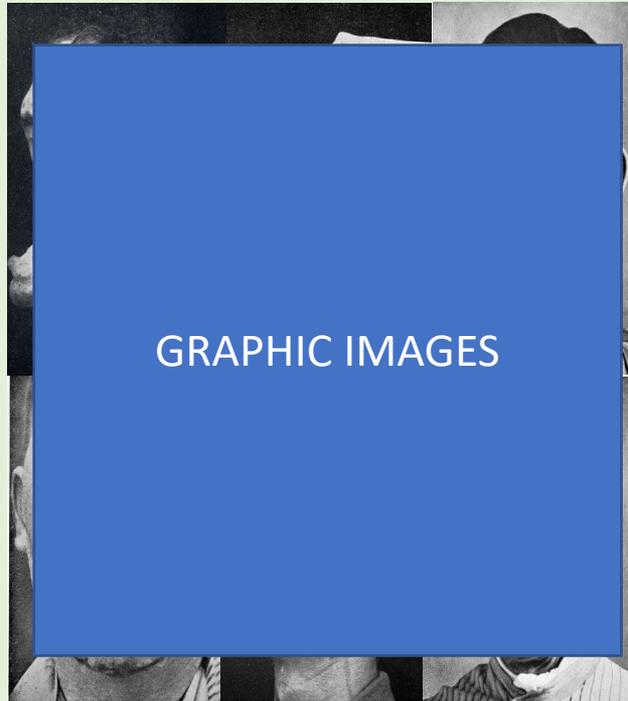
GRAPHIC

WWI plastic Surgery video

## 6. Plastic Surgery

The development of plastic surgery was largely the world of **Doctor Harold Gillies**. Before the war he was an ENT (ear, nose and throat) surgeon. He was sent to the Western Front in January 1915. Head injuries that didn't kill could cause severe disfigurement. This led Gillies to become interested in facial reconstruction. He had no experience in this work so devised new operations as he met each patient.

The intricate operations and recovery that were required in plastic surgery could not be carried out in France so it was done in Britain. Gillies helped design the Queen's hospital in Sidcup, Kent to meet his needs. By the end of the war, nearly 12,000 operations had been carried out!



Source G

## Source H

From *A Surgeon's Journal 1915-18*, by Harvey Cushing, published in 1936. This work is made up of extracts from the journal kept by American surgeon Cushing during the war. Here he is describing his first impressions of medical treatment on the Western Front soon after his arrival in France on 2 April 1915.

It is difficult to say just what are one's most vivid impressions: the amazing patience of the most seriously wounded, some of them hanging on for months; the dreadful deformities (not so much in the way of amputations, but broken jaws and twisted, scarred faces); the tedious healing of infected wounds with discharging sinuses, tubes, irrigation and repeated dressings. Painful fractures are simply abandoned to wait for wounds to heal, which they don't seem to do.

### The value of evidence

Read Source H, then work through these tasks.

- 1 Write down at least two ways in which Cushing's memoir is useful for explaining injuries on the Western Front.
- 2 Compare your answers with a partner, then try to come up with at least one limitation of the source.
- 3 With your partner, decide how useful this source is for explaining injuries on the Western Front on a scale of 1 to 10 (10 being very useful).
- 4 What if the source was used to answer the question: 'How is Cushing's memoir useful for explaining the work done by surgeons and doctors on the Western Front?'
  - a Write down any ways in which the source is useful for answering this new question.
  - b Write down any limitations for answering the new question.
  - c With your partner, decide how useful this source is for answering the question on a scale of 1 to 10.
  - d Can you think of another enquiry for which this would be a useful source? Write it down and score the source on a scale of 1 to 10.
- 5 Compare your scores out of 10. How does the question being asked affect how useful a source is? Explain your answer.
- 6 Can you think of any other factors that might affect the usefulness of the source?

## Summary

- Many new medical techniques and ideas were pioneered to meet the needs of those wounded on the Western Front.
- The Thomas splint was responsible for a dramatic decline in the number of deaths of men who received leg wounds.
- Mobile x-ray units enabled surgeons to see where shrapnel and bullets remained in the body. This reduced the number of deaths from infection by gas gangrene.
- The first use of stored blood in blood transfusions was at the Battle of Cambrai.
- Harvey Cushing developed new methods of brain surgery.
- Harold Gillies developed the effective use of plastic surgery for men who had suffered severe facial injuries.

## Checkpoint

### Strengthen

- S1** List the different medical techniques used to treat the wounded on the Western Front.
- S2** Explain the significance of the Blood Bank at Cambrai.
- S3** What can you learn about plastic surgery from Sources G and H?

### Challenge

- C1** Look at the ways in which medical techniques improved. Which of these improvements do you think was the most important on the Western Front? Explain your answer to a partner. Do you agree with each other?
- C2** How useful are Sources A and B as a study on treatment on the Western Front?