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Ladies and gentleman, welcome to the Royal College of Surgeons, my name is Sam, I work here in museums and archives, I've delighted to welcome you to the first of the lecture series commemorating the 100 anniversary of Lord Lister, who died this month in 1912.

It gives me enormous pleasure to introduce our first speaker, Prof Harold Ellis, who fortunately needs little introduction, because we only have an hour and it will take that long, even to tell you the titles of his many works, accomplishments and prizes.

Needless to say is familiar to many of you as an inspirational surgeon at Westminster, Cambridge and Guy's. It's a mark of his continued activity in this area that I was at the foundation meeting of the Association of British Universities Surgical Societies, there was a couple of dozen students in the room and they went round and said what their activity this year would involve, half of them said they had already had a lecture from Professor Ellis and the other half were planning theirs, these are groups all over the country, a mark of extraordinary dedication to teaching.

He has student prize for surgery, run by his college, named for him, and is vice president. Today we meet him in the guise of one of the foremost surgeons, he will be kicking off the lunch lecture series appropriately by talking about Lister's early years. Professor Ellis.

Prof. HAROLD ELLIS: Thank you very much, after that introduction I can hardly wait to hear myself speak *{laughter}*.

Well, as you must all know by now, this is the centenary of the death of Joseph Lister, who died in 1912. I have to confess that he has always been, since I was a medical student, my surgical hero. I would think

everyone with an interest in surgical history would say that Lister made the greatest contribution of anyone to the science of surgery, indeed, to this day we divide surgery into the pre-Listerian era and post-Listerian era, that shows his place in medical history.

He was born in Upton, a little village, born in 1827, a little village in Essex and this is a picture of Upton House, in the town of Lister's early youth. The house has disappeared and Upton is now swallowed up in the suburbs of East London. There is no use going to Upton and hoping to find a little country house in a village there, it doesn't exist any more.

His father - this is the only picture I've got of him - this is a sketch he made of himself, Jackson Lister, Joseph Jackson Lister, a very interesting man, a Quaker and a teetotaler, he made a considerable living as a wine merchant, an unusual thing for a Quaker to do! His hobby was science, particularly interested in optics and indeed he made a great contribution to it. This is Lister's microscope, our Lister, Joseph Lister's microscope, you will see this in the Huntarian Museum.

This was the invention of Jackson Lister, because he invented the achromatic microscope, if you use an ordinary one there is a halo around the edge, which is very distracting, that gets worse and worse the more powerful the lens is. It was Lister's father who showed that if you combine it very cleverly with a concave lens, you produce the achromatic microscope, for that he was made a fellow of the Royal Society. He wasn't satisfied with that, he made some very interesting microscopic observations, with Hodgkins, at Guy's Hospital, he actually described for the first time the exact appearance of red blood corpuscles, the biconcave structure.

I'm so sorry, it's one of the terrible slips - I hope there is nobody here for UCH, they are nice chaps there - he went to UCH, while he was with Ericsson he made some very interesting observations using the achromatic microscope, he looked at all the common things in the wards, he saw that they were invaded with pustules, we're very familiar with these in infected

materials, he also saw little tiny particles in this material that was later realised was Pasteur's observations of microbes, an extraordinary thing.

Ericsson realised he had a bright young man, he sent him to his friend James Sign in Edinburgh as his assistant. Sign devised the Sign amputation of the ankle, which I've only done once in my life, on a poor Canadian nurse who was blown up in the IRA, the Hyde Park bombing. He also had a very nice daughter Agnes, and Lister married the girl.

Here is young Agnes at the time of their wedding, there is young Lister. There we are. There is Agnes, there is young Lister. She became - unfortunately they hadn't got any children, which was sad - but she was a lifelong companion of Lister who helped with experiments, wrote notes and made diagrams for him, she was a great help to him.

Well, Lister, at the age of 35, here he is just then, was appointed Professor of Surgery in Glasgow. His interests were wound healing and wound infection. I was appointed Professor at Westminster at the age of 35 and my interests were wound healing and infection. There, ladies and gentleman, any resemblance between Lister and Ellis ceases *{laughter}*.

Like so - well, let's just look at the next one - this is the wards, Lister's female and male ward where much of his work we are going to describe was carried out.

Lister, like so many surgeons before him, couldn't explained the following phenomenon: two people are brought into your hospital after a road traffic accident, one has got is tibia, bone in his leg, smashed to pieces, a comminuted fracture but the skin is intact, the other one has a very simple spiral fracture of the bone, nothing very much, but it's through the skin, a little wound. Every surgeon knew that the chap with the smashed up leg, but with the skin intact will be in hospital and under treatment for week after week and month and month as the bone gradually knitted together, but his life wasn't in danger. The chap with the silly wound, that big, *{demonstrates with fingers}* had a very great chance of disaster. Lister, when he arrived at his job,

analysed the infection rate and the amputation rate for compound fractures at the Glasgow Royal Infirmary, that's to say fractures complicated by injury to the overlying skin.

He found that of 100 patients with compound fractures of the bones admitted to the Glasgow Royal Infirmary, 50%, 1 in 2 died, 90% ended up with amputation. These were terrible figures which were very distressing.

Of course people were very interested in this, why is it that the little wound underneath went this terrible infection, whereas the smashed up bone was intact? So the theory was it's 'air', if air gets into the wound this suppuration, this awful infection which I'll talk about in a moment took place. John Hunter, you know all about Hunter from the Hunterian Museum here, Lister said to him, "It's crazy, it's nothing to do with air getting in the wound." Both these shrewd, clinical observers made the same observation, often if you fracture your rib, a part of the rib goes in to the covering of the lung and air escapes into the chest wall, surgical emphysema, there is air surrounding the fracture. There is a fracture with air in, it nothing happens there, they heal beautifully, they never suppurate, that theory whatever it is, doesn't hold water.

Well, as I say, they were very familiar with, with wound infection. Now, of course in those days there was no photographs of wounds as we see now in the text books and the articles, but we are very fortunate that I'm able to show you what we're talking about because this Edinburgh surgeon, Charles Bell, who was a surgeon at Middlesex Hospital in 1815, the news came that the Battle of Waterloo had taken place and Bell gathered his assistants together and said, "We're going over the channel boys to help the wounded", and spent the next week or two dealing with the vast numbers of wounded soldiers on both sides of the conflict at the Battle of Waterloo, as well as being a remarkable surgeon and physiologist, described as Bell's Palsy, he was a great artist. He made sketches of the wounded, when he got back to London he painted them, here are some examples: here is a patient whose arm has been blown off by a howitzer shell, the chap is desperately ill, the wound is infected, swollen, the chap is obviously very toxic and ill. A typical result with an injury involving the bone. Here is a poor chap with a

compound fracture of the skull, desperately ill, swollen, the man toxic probably going to die, as well as that of course there were the awful results of wound infection, tetanus. Here is a dramatic painting which you will find in the library of the Edinburgh College of Surgeons of a patient under going titanic spasm.

The wonderful thing about working in the university, you meet people in other specialities. It was Thomas Anderson, a professor of surgery who in 1865 told Lister of Pasteur's publication - up to 1860 Pasteur, of course being a Frenchman, published in French. Lister was well familiar with French and German surgical literature, but being a surgeon didn't read the chemical journals, there was a wonderful cross-fertilisation of chemist to surgeon, telling him the work of another chemist in France. Pasteur was the chap who did all the classic experiment where he showed that milk, urine, wine, anything you like, if you leave it out in the open air becomes smelly, a crust forms over it, there are a little things that we now know are bacteria. If you boil the milk, or the urine or the wine and you put a bit of a cotton wool in the top so that air can get in but the cotton wool will filter out the microbes, nothing happens to the water, the wine or the milk. So there is Pasteur, another remarkable man.

This is very interesting, because this is the lecture notes of one of Lister's students at Glasgow. Now, when I lectured to the student in surgery at Westminster, I tell them about piles, hernia and lumps and bumps, but Lister's surgical lectures to the students were telling him about the classical Lister, here he is boiling the milk, urine or wine with this arrangement of tubes over it, so this is bacteria killed. You break off the bit of glass there and the air - bacteria dropping in like this, but the bacteria can't get round the tube there and this exposed to the air, remains unable for bacteria to get in, remains sweet and clean; remarkable.

Of course Lister's mind was prepared for this because he had seen these things, through his microscope, when he was a house surgeon, his mind was averted to this. Lister made some interesting observations, this was much later on when Lister was - having trained in Scotland was very economic, he found that urine was a very good medium to use for growing

bacteria. In one of his experiments he found that the urine in his tube was absolutely free from infection. There was a crust growing on it, when he looked at the crust carefully he found these spores of what his brother, who was a micrologist, identified as penicillin, the blue mould. There was Lister making an observation made years later by Fleming at St Mary's hospital, remarkable science.

Now Pasteur's work, it wasn't the air getting into the wound it was the microbes, Pasteur's germs getting into the wound. In the environment of the Glasgow Royal Infirmary where the smell was atrocious and patients were lying next to infected cases the chances of the wound becoming infected was pretty well 100%.

So Glasgow, Glasgow was the site of the first antiseptic operation, 12th August 1865.

Of course it's all very well for Pasteur to boil the milk or the urine or the wine, you can't boil a compound fracture! Lister experimented with various chemicals and came up with the idea of using carbolic acid. Carbolic acid had been used for cleaning the drains. Lister knew very well that the smell of the surgical wards at the Glasgow Royal Infirmary were similar to the smell of the drains: carbolic, excellent. The patient was a little boy who was 11, he had been knocked over by a wagon, a compound fracture of the tibia and fibula, there was a little one and a half inch wound over it like that where the bone had stuck through, the sort of thing that the senior house officer would fix up today without any thought. In those days this little boy, James Greenlees, the figures were he had a 90% chance of losing the limb and 50% chance of dying.

This was the - the operation wasn't done in the operating theatre it was done inside the ward. This picture was taken in the earlier 20th century when the old Royal Infirmary was going to be pulled down, but they preserved this room with Lister's portrait there for historic value, they photographed it before the whole building was pulled down. This is a painting of the scene, there is James Greenlees, there is Lister, there is Lister's sinus forceps which

he used, the ward sister and staff nurse. What Lister did, he very carefully mopped out the wound with pure carbolic, undiluted, crude, put a big dressing or gauze over it, carefully splinted the leg, this was the big experiment.

This is a very good painting, he's got everything right has the artist who was medically qualified, one thing is wrong. He's painted a little 11-year old American boy, of about 1950, James Greenlees would have been a Glasgow type, rachitic and sclerotic as well. Now, the critical experiment, he left the leg splinted, untouched for four days, because he knew very well that any other patient admitted to the Glasgow Royal Infirmary surgical ward by four days, if he was still alive, if he was still alive, would be desperately ill, high fever, flushed, toxic, the leg swollen, the skin gangrene, perhaps bubbles of gas gangrene coming out of it. As it is, James is lying there looking fit and well. Lister took off the dressing, took off the splint, removed the dressing, skin was a bit red, he was using undiluted carbolic, apart from that no problem at all. Little James walked out of hospital with both legs *in situ* a couple of months later.

Any surgeon in 1865 would have rushed off to the Lancet, or the British Medical Journal and said, "Stand back, I've made a great discovery." Lister waited two years before he published anything about it, he went on and on and on.

In 1867, two years later, in a series of 1, 2, 3, 4, 5 - that should be volume 2 - five papers he wrote this article. I've done, I've done you the benefit of reading through them very carefully. Scattered through the papers are reports of 11 compound fractures treated by this new method, new method of treating compound fracture *et cetera*.

So, as I say I've done the work for you, the first 11 cases compound fracture. Case number one James Greenlees, "r" equals recovery. Number two, male aged 32, kicked by a horse, hospital gangrene, amputation. What happened there? Lister went on holiday, that's the only thing about Lister that stops him being my hero, he went on holiday in the middle of all this! {*Laughter*}

As soon as his back was turned, they said, "Carbolic! Let's get out the germicide...", or what ever they were using. Lister came back, the leg was gangrenous, amputation.

When I was Professor of Surgery my Registrars weren't allowed to go on holiday, I would say, "Look what happened to Lister!" I was a tyrant in those days, I've matured since then.

So recovery, recovery, recovery, death. This was a very sad case, 57-year old man, a quarry man and there was a fall of rock on to his leg. He came in with an absolutely smashed up femur, comminuted and compound fracture with an open wound over it. It was carefully treated and the patient was doing well and then, a few days later, in fact ten days, if I remember, he started spurting arterial blood out of the wound, a secondary haemorrhage. The surgeon on duty rushed in to tend the wound, tied the femoral artery there and then to stop the bleeding. Reading the notes, if it had been today and they had had blood transfusion, they would have given him a pint of blood and he would have recovered. The leg was all right but he just died of massive haemorrhage, that was a great shame. Recovery, recovery, recovery.

So, do you see, here are 11 cases and, as I say, you would have expected that of those 11 cases, as I say, half of them would have died. So let's say 4, 5, 6 of these would have died. Pretty well all of them would have ended up like this poor chap with an amputation. I've actually got - I'm no good at statistics - I've got a very good statistician to go over these figures and he said, "That is statistically significant."

Well, Lister's technique was interesting because, as well as using carbolic as a dressing of course he surrounded the wound with carbolic soaked towels. He carefully soaked his hands in carbolic, in the instruments, the dressings in carbolic, then he decided the right thing to do was produce an aerosol of carbolic in the surgical room, they nicknamed this the Donkey Engine, it produced a tremendous spray of carbolic in the room, these were other modifications of the machine, we've got one here to show you. In fact this wasn't necessary and you can just imagine that working in an aerosol

spray of carbolic was not pleasant, but the operative method was simplicity itself: this drawing is said to show Lister operating. I don't know... I don't think so, but certainly it would be identical with the procedure that we would expect him to have done. The patient is anaesthetised, in Scotland probably chloroform, the surgeons soaked the hands, dressing and instruments in carbolic, very, very simple technique. With that technique Lister were able to do things that other surgeons didn't dare perform. So Lister started operating on non-compound fractures, fractures where the skin was intact. If anybody had suggested before Lister that you should operate on a fracture which hadn't got a wound over it they would say, "You're crazy, you are converting that safe fracture from which the patient won't die into an open wound with a 90% chance of amputation, 50% chance of dying." Lister said, "Provided you use my technique it's perfectly safe to operate on fractures." Here's the first report, series of papers in the Lancet with a patient with a fracture of the elbow, he was hurt some little time before - his elbow was absolutely useless he couldn't move it at all. Lister operated on him and put a wire through the ends of the bone, the ulna, the bone at the tip of your elbow. The patient made a smooth recovery. He did the same with the knee-cap, he did the same, operated on patients {inaudible}.

Modern medical students simulating Lister's operation, they dressed themselves up, used Lister's spray, there is the little bottle of chloroform, they are mimicking Lister, Lister wouldn't have allowed this, the patient's arms down like this, you would probably pull out all the nerves of his neck, that's a good picture to show what not to do!

As I say, Lister's technique was simplicity itself and the interesting thing was, although his results were remarkable a lot of surgeons didn't believe what he was saying. They thought carbolic was just number one of the hundreds and hundreds and hundreds of dressings that people have been using since the time of Perret, they thought it was just a bit of carbolic. They would drop a scalpel on the floor and pick it up again, they wouldn't wash, they would go from a septic case straight to the operation and the wound

would separate again, carbolic wasn't any different they didn't realise that it was the carbolic.

It was quite difficult for people in the UK, particularly in the south of England, the Scots took it up but the English were diffident about this. Interestingly it was visitors from the continent, particularly from Germany, who came to watch Lister at work, first of all in Glasgow then Edinburgh, later still in London and modified his technique into so-called aseptic surgery where the instruments were sterilised by boiling, the gowns and so on. Things started to improve.

Here's an operation where they have taken off their day clothes and they have put on special operating gowns. They have an apron there, but they are still using bare hands that they clean by scrubbing or antiseptics. By the end of the century things look more and more like a modern operating theatre, although they are still not wearing masks, things are looking cleaner and better.

Then we come to modern times, masks, gowns and gloves and all the impedimentary of a modern theatre.

Gloves came late to modern use. The story is interesting, you see by 1867 Lister announced to the world the antiseptic treatment of wounds but for the next few decades, right up to the 1890's, people were operating with bare hands. This is interesting because this man here is William Halsted, of the Johns Hopkins Hospital in Baltimore, it's well-known that he was one of the first people to use surgical gloves. The story is interesting because this theatre sister, Caroline Hampton came to him one day and said, "Dr Halsted, I can't scrub up with you any more, I'm going to resign as a theatre sister." Any surgeon will tell you they can do without most things, secretaries, wives in most cases, but not a theatre sister! He was shocked, he said, "What's this about?"

"It's this antiseptic, look at my hands, they are red raw, sores all over the place. It's agony, dipping my hands in this antiseptic, I've got to stop." So to cheer himself up he went to see a post-mortem of one of his patients that just

died {laughter}, where the famous Claude Welch, was doing - he was the Professor of Pathology at Baltimore - and Welch was doing the post-mortem with big rubber gloves on his hands and Halsted said, "What's this with the gloves?" He said my wife was absolutely fed up with me because of the stench I used to bring home from the post-mortem. She was threatening me to withdraw my conjugal rights. So I went along to the rubber people and they made these gloves. I put the gloves on, do the post-mortem and my marriage has been saved. So, seizing a pair of Welch's gloves he rushed back to Miss Hampton - by the way it's interesting that in this photograph you will see that one of his assistants, a chap called Finny, a great surgeon, then a resident, he's wearing an old-fashioned, rather crude, rather thick rubber glove - Halsted rushed back, gave Caroline the gloves and her hands became absolutely beautiful and he married the girl! Say 'Ahh', thank you! {laughter}

Of course nobody talked about them, Halsted never published this, it was word of mouth. People said, "What's all this about gloves?" They were used originally to protect the surgeon from the antiseptics, people said, "I'll have a pair of those", and it spread by word of mouth. Amazingly enough, the first paper about using surgical gloves was in 1897 from, of all places, Estonia, the Professor of Surgery in Tartu. So you see 1870... 1867, so it took 30 years, 30 years from Lister's publication in the Lancet, to the first publication on using gloves in the operating theatre. I'll translate from the German: "To wear boiled rubber gloves is to have boiled hands."

Gloves always fascinated me, at Westminster we did a lot of work developing the modern gloves. They are now very smart, come in plastic things, they are disposable.

It takes a moment to put on and they are so beautifully thin that you really hardly know that you have anything on your hand. Wonderful, but they have taken a lot of evolution to the modern glove that we use today.

Well, of course Lister went on to become the famous man that we know today. He moved from Glasgow in 1869 to become a Professor in Edinburgh, he spent about eight years there. He was very upset, he was

really you know - he was calmness itself, but he was distressed that people on the continent accepted what he was saying but people in the south really were a bit resistant to all this new-fangled operating technique, which was a bit of a nuisance for old Lister. So he decided, after a lot of thought, to migrate down to London and, in 1877 until he retired, he was Professor of Surgery at Kings. His first years were not particularly happy, the students didn't like his lectures, as I say, instead of telling them how to differentiate between a direct and indirect hernia he was busy telling them about Pasteur's work in Paris.

Surgeons very slowly accepted his work, although having said that, by the end of the century it was well-established. In contrast, you see, to the discovery of anaesthetics, as soon as 'ether' got into the papers, people thought it was a good thing.

He was the first surgeon to enter the House of Lords. He was one of the first of a group of people to receive the Order of Merit introduced by Edward VII when he came to the throne in 1902.

If you go to Portland Place, just north of the BBC, just spend a moment to look at this statue. It's got two words on it, on the front it says, "Lister", and on the side it says, "Surgery", and you are expected to know the rest! {Laughter} Absolutely gets my goat! {Laughter} There are thousands and thousands of statues to generals who have wiped out so many people. There are two statues that I know to surgeons, not just in London, but in this country, one is in Portland Place, Lister, the other one you will see in Leicester Square which is to our John Hunter who lived just off Leicester Square when he was in practice there.

So, I think I've made my case, that you can divide surgery into the pre and post Listerian era. Lister was, undoubtedly, our greatest surgical scientist. Thank you very much.

Applause.

Well, thank you very much indeed, I'm sure there will be questions. If I could just ask you to make your question as brief and straightforward as possible for the Speech-to-Text and for the other listeners please.

FROM THE FLOOR: Can I ask if there is any link between Lister and Fleming, in their lifetime?

Prof. HAROLD ELLIS: No, none at all, none at all - so far as I know. It was very interesting that everybody knows that Fleming discovering the penicillin spore, fortuitously, in the 1920s at St Mary's. When Howard Florey and Ernest Cheyne in Oxford in 1940 wanted to investigate Fleming's work, because there was an extraordinary thing that a fungus, a bacterium, can inhibit - so sorry, a fungus can inhibit bacterial growth. Ernest Cheyne went to the science library in Oxford and dug out a couple of hundred references, including Lister, of people who made the same observation that fungus, growing on plates, can inhibit bacterial growth. Lister himself said that this might be of some value. Pasteur had made this observation and said, "I don't understand it, but one day this could be of clinical value."

So, Fleming, great chap though he was, was not really the father of antibiotics, I'm sorry to say. Yes.

FROM THE FLOOR: Two short questions, one is: I could see that the surgeons changed from wearing their outdoor clothes and things attached to them, then wearing later, much later on, going into whites. I just wondered what was the actual date of the changeover?

Prof. HAROLD ELLIS: It was a fairly - it was a slow process. When I was a young surgeon a lot of surgeons would come in to the operating theatre, take their jacket off, some of them would remove their tie and put a, put a plastic apron on and then very meticulously scrub up and put gowns on. It worked very well - I think we changed to save our clothes getting dirty.

FROM THE FLOOR: The other thing was women in child birth, many of them died from fever, there wasn't any mention if treatment was given to them?

Prof. HAROLD ELLIS: The interesting thing was, that Ignaz Semmelweis in Budapest, he said that they carry some fluids from the septic cases into the birth passages of the women who are delivering, do you see? Poor old Semmelweis died in the year that Lister published his paper, if only he had lived another year people would say, "What you say is true."

FROM THE FLOOR: What was the effect of the surgeons wearing the huge gloves?

Prof. HAROLD ELLIS: It was difficult, it was difficult, of course they gradually improved them. A lot of surgeons doing the delicate operations would take the gloves off and operate. Providing you have scrubbed up well there is no reason why you shouldn't use bare hands. I did my obstetrics as a student during the war. I have to say that - during WWII *{laughter}*, not the Gulf War! *{Laughter}* So I did my obstetrics in 40... umm... 46. Gloves were in very short supply and they were reserved for major surgery. So we delivered babies by scrubbing our hands very carefully and then putting Dettol cream on it. To this day I can't bare the smell, it reminds me of the labour wards in Oxford. We scrubbed up very carefully and the sister used to time us and we put antiseptic on our hands, that made our hands very sore. Gloves were a luxury.

FROM THE FLOOR: Thank you.

FROM THE FLOOR: Do you think---

Prof. HAROLD ELLIS: Eye surgeons, at least until recently just washed their hands they needed every bit of tactile help. Yes.

FROM THE FLOOR: ---do you think Lister has been maligned over this question of the spray, I mean he thought there was something in the air that was pooh-poohed. 100 years later, John *{inaudible}* the pioneer of hip

replacements discovered there is a lot in the air, in theatres, as a result professionals have said *{inaudible}*.

Prof. HAROLD ELLIS: Absolutely. The trouble was that, I mean, you can just imagine you and I working in a mist of carbolic acid, it's very unpleasant, yeah, coughing and spluttering, eyes watering, hands sore. I think that Lister's Donkey had to go, but it's been replaced by other things. The theory was right, it was the practice that was harmful.

They are exhausted.

NEW SPEAKER: If I may beg your patience just to make four thankyou's. Firstly to Johnson & Johnson who supported this lecture series that we are very pleased about, because of the historic connection between the company and Lister, there were solicitors in the United States and Johnson II was inspired to set up the company.

I would like to thank Hayley, the archivists, who have set up a display of original material on the table at the back there for you to have a look at. I'll reserve the fourth thanks in just a moment. If I can just plug the next in our series of Lister lunches, it's on the 6th March at 1 o'clock, Sir Barry Jackson, talking about 'Carbolic, Casebook and Controversy'. I think it will be in the Webb-Johnson Hall downstairs, not least because there will be a surprise at the end of that lecture!

Then we have, later in the month, a conference devoted entirely to Lister on 22nd March which details, details of which you will find on our website or in the brochures that should be on your chairs there. So, finally, the fourth and final thanks is to our speaker for a wonderful, educational and informative talk. Thank you very much.