Topics in the History of Medicine. 2023; Volume 3: 63-76.

Walter Calverley Beevor, the Tirah Campaign and the Origins of Military Radiology

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Abstract

Following the discovery of X-rays by Wilhelm Conrad Röntgen (1845-1923) in 1895, military surgeons almost immediately realised their potential value in military surgery. Surgeon-Major Walter Calverley Beevor (1858-1927) used the new technology with good effect in adverse field conditions during the Tirah Campaign of 1897-98 in the North-West Frontier of India. Beevor gave a presentation to the Royal United Services Institution in May 1898 when he showed and described radiographs in different cases of bullet wounds where the use of X-rays had been invaluable. Beevor concluded that radiography alleviated the sufferings of many wounded men and allowed the preservation of limbs, and that a Röntgen ray apparatus 'would seem to be a very great addition to the medical equipment of a force'. This recommendation was soon implemented and Beevor's work marked the introduction of field radiography units into the British Army.

Keywords

Afghanistan, Military radiology, North-West Frontier, Röntgen, Royal United Services Institution, Tirah Campaign

Introduction

In 1945 at the end of the Second World War, Lieutenant-Colonel Lewis Etter (1901-79) from the Medical Reserve Corps of the United States Army visited Würzburg in Germany. His purpose was to pay tribute to Wilhelm Conrad Röntgen (1845-1923) who

had discovered X-rays at Würzburg in 1895.[1] This area of north-western Germany had been devastated during the recent war, but remarkably the laboratory of the Physical Institute had survived. It was 50 years earlier that, in this laboratory, Röntgen had discovered the X-rays, and during the intervening period both the practice of warfare and of medicine had changed beyond all recognition.[2] [3] [4] In 1915 Emperor Wilhelm II (1859-1941) awarded Röntgen the Iron Cross 2nd Class for the contribution that his discovery of the X-rays had made to military surgery and the German war effort.

As our technology has advanced, humanity has developed increasingly sophisticated weapons for warfare and conflict and as a result medicine has had to adapt to the volume and changing nature of injury. Following the discovery of X-rays in 1895 it was immediately obvious to military surgeons that this new method would be of great value for the management of war wounds.

At the end of the nineteenth century there had been rapid changes in military technology. As an example, the older variety soft lead bullets were replaced by new bullets that were steel jacketed. Throughout the 1890s the European governments were equipping their armies with the newer and more powerful magazine rifles, such as the Martini-Henry and the Mauser. The new high velocity bullets would result in only a small entry wound and would commonly pass straight through the body. The older gaping entrance wounds that had been commonplace before were no longer seen, and it was realised that the practice of exploring the wound for bullets could be more harmful for the patient than a policy of careful observation.[5]

The introduction of radiography would allow the military surgeon to determine the presence and site of any retained material. The younger generation of regimental surgeons who saw the value of the X-rays were from a generation trained in the Listerian concepts of antisepsis and in the germ theory of Louis Pasteur (1822-95). In Great Britain many of the young doctors had been attracted to the newly established Royal Army Medical Corps (RAMC) and to the professional career that it provided. The RAMC set military medicine on a professional footing.

Although the new technique of radiography was obviously important, the technical aspects were difficult and the early X-ray tubes were very fragile. The process of taking radiographs was essentially photographic and as such was termed 'The New Photography'. However, in spite of its limitations, the apparatus available before 1900 could detect both fractures and foreign bodies with confidence.[6]

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[1] Etter LE. Post-war visit to Röntgen's laboratory. *American Journal of Radiology*. 1945; 54: 547–552.

[2] Röntgen WC. Über eine neue Art von Strahlen. Vorläufige Mittheilung. *Sitzungsberichte der Physikalisch-Medizinischen Gesellschaft zu Würzburg*. 1895; 137: 132-141.

[3] Burrows EH. *Pioneers and Early Years: A History of British Radiology*. Alderney: Colophon; 1986.

[4] Reynolds L. The history of the use of the roentgen ray in warfare. *American Journal of Radiology.* 1945; 54: 649–672.

[5] Thomas AMK, Banerjee AK. *The History of Radiology*. Oxford: Oxford University Press; 2013.

[6] Guy JM. British Military Radiology, 1897–1919. In: Thomas AMK (ed). *The Invisible Light: 100 Years of Medical Radiology*. Oxford: Blackwell Science; 1995. p.39–41.

The Royal Victoria Hospital at Netley

The Royal Victoria Military Hospital was located at Netley near Southampton in England, opening in 1856 with a final closure in 1978 and demolition. In an article from 1897 about Netley Hospital it was noted that 'The developments, of late years, in artillery and infantry fire increase the proportion of the wounded'.[7] In May 1896 there was a demonstration at Netley by Sydney Rowland (1872-1917) to Surgeon-Colonel William F Stevenson (1844-1922), Professor of Clinical and Military Surgery, of the radiographs of a soldier with a complex tibial plateau fracture.

Rowland wrote that 'preparations are in active progress and that in all probability a skiagraphic outfit will form part of the equipment of future expeditions in which bullet weapons are to be dealt with'.[8] The term skiagraphy is derived from the Greek word for shadow since a radiograph is essentially a photograph of a shadow. Sydney Rowland was the editor of the *Archives of Clinical Skiagraphy* which was the first radiological journal in the world and which continues today as *The British Journal of Radiology*.

In 'Literary Cuttings', an album of press cuttings, photographs and reports, Lieutenant-Colonel William Dick (1865-1917), who as Surgeon-Major had been Assistant Professor of Clinical and Military Surgery at Netley alongside Colonel Stevenson, proudly preserved an 1898 article about the new technological development:

> Of the scientific attainments brought to bear in treating the wounded here, I had an opportunity to form a judgement from personal observations. Colonel Stevenson and Major Dick, professors of surgery at the school, were engaged in experiments with the latest appliances for locating bullets by Röntgen rays ... What bungling and haphazard all former methods seem to be by comparison with this! [9]

By the middle of 1898 X-ray sets were either being operated or were being installed at British military hospitals in Netley, Aldershot, Dublin, Woolwich (The Royal Herbert Hospital) and Gibraltar.[10]

It is also of interest that in 1903 the British Army Medical School at the Royal Victoria Hospital at Netley offered 'A course of x-ray instruction' and this was the start of the first school of radiography in the world. In 1910 Colonel Stevenson wrote that 'There is, of course, no question as to the necessity of x-ray apparatus and an officer qualified in its use being supplied to all general and stationary hospitals in war'.[11] All

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[7] Graham J. Netley Hospital. *The Navy and Army Illustrated*. 19 March 1897. p.208.
[8] Rowland S. The value of the new photography in military surgery. *British Medical Journal*. 1896; 1: 1059.
[9] Lieutenant Colonel William Dick's album of newspaper cuttings, including material re the Royal Victoria Hospital at Netley, impressions of a journey to Japan, theatrical productions in which Mrs. Dick took part, feats for which the Victoria Cross was awarded, and obituaries. Wellcome Collections Archives. RAMC Muniments Collection. RAMC/463. See: https.//wellcomecollection.org/works/xf2h6j4z/items?canvas=80 (accessed 8 December 2023).
[10] Burrows. *Pioneers and Early Years,* 1986 (Note 3).
[11] Stevenson WF. *Wounds in War: The Mechanism of their Production and their Treatment*, 3rd Edition. London: Longmans Green; 1910.

that now remains of the Royal Victoria Hospital is its chapel and a park which contains an interesting museum.[12] The significance of the Royal Victoria Military Hospital over other military hospitals was related to its academic excellence and modernity compared to other establishments.[13]

The New Photography in warfare

There was an immediate use of radiography in military surgery and between 1896 and 1900 the apparatus was used in a succession of conflicts.[14] The first recorded use of radiology in war wounds was during the First Italo-Ethiopian War (1895-96), when the Kingdom of Abyssinia was invaded by Italian forces. Italian casualties from the Battle of Adwa, which took place on 1 March 1896, were examined back in Italy at the Military Hospital at Naples during May 1896. Radiography was then used in the Græco–Turkish War which started in the Balkans in the spring of 1897. The European nations were divided with Germany supporting the Turkish side and Britain, Russia and the French supporting the Greeks, and both sides employed radiography. In June 1897 there was insurrection in the North-West Frontier of India along the border with Afghanistan and a British Expeditionary Force was sent in October. It is this Tirah Campaign (October 1897-April 1898) that will be discussed in this paper.

Afghanistan and the Tirah Expeditionary Force

In October 1897, due to the unrest in the North-West Frontier of India, an Expeditionary Force under General Sir William Lockhart (1841-1900) who was commander of the Punjab Army Corps, was dispatched to open up the mountain passes. The army consisted of 65,000 soldiers equipped to the latest Western standard of equipment. The campaign is well described by Captain Leonard J Shadwell (1861-1930) of the Suffolk Regiment in a classic account *Lockhart's Advance through Tirah*.[15]

The Tirah Expeditionary Force consisted of 8,000 British and 30,000 Indian soldiers under the command of General Lockhart with the stated aim of confronting the Afridi and neighbouring tribes, which numbered in total about 25,000 fighting men. The Afridi were armed with primitive weapons including swords and matchlock guns and about ten per cent were carrying breech-loading rifles. The frontier post of Kohat was selected by the Force as their base for the campaign. In total 23 field hospitals were established on the Tirah plateau and 900 casualties were received. The geography necessitated a long journey back to the base hospital at Rawalpindi with very slow transport of the wounded,

[12] QARANC. Netley Hospital. https://www.qaranc.co.uk/netleyhospital.php (accessed 11 April 2023).
[13] Friends of Millbank. Army Medical School. https://www.friendsofmillbank.org/med-school/ (accessed 3 June 2023).
[14] Thomas AMK. The first 50 years of military radiology 1895–1945. *European Journal of Radiology*. 2007; 63: 214-219.
[15] Shadwell LJ. *Lockhart's Advance through Tirah*. London: W Thacker; 1898.

and as a result the military surgeons treated wounds earlier and nearer to the front line than would be usual then.[16]

In retirement, Field-Marshal Sir Charles Henry Brownlow (1831-1916) collected his notes and letters to be printed by way of a contribution to military training.[17] As a senior Indian Army officer experienced with the situation on the North-West Frontier he wrote an analysis of the situation there in 1897.[18] In 1889 he had written about the possibility of a Russian invasion of Afghanistan and saw Kandahar as sealing the routes to India by Baluchistan, commenting that it must be taken possession of by an enemy before an invasion of India would be attempted. In the event of a Russian invasion Brownlow thought that the position at Kandahar should be consolidated with strong outposts on the Helmand River. British India would be able to fight a decisive battle on the Helmand, without reinforcements from England, against all that Russia could bring against her.[19]

Brownlow was correct in his estimation of the importance of Kandahar. There was a long history of conflict and British-led Indian forces from neighbouring British India had invaded the city in 1839, during the First Anglo-Afghan War (1838-42) but had to withdraw in 1842. The British and Indian forces returned to Kandahar in 1878 during the Second Anglo-Afghan War (1878-80). They emerged from that city in July 1880 to confront the forces of Ayub Khan but were defeated at the Battle of Maiwand. They were again forced to withdraw a few years later despite winning the Battle of Kandahar.

Brownlow obviously had a great deal of respect for the Afridi. He noted that they had never known a ruler, and that they would not give up their independence after one short campaign. Even if the Afridi were to surrender their arms, they would soon arm themselves again. He noted that military action on the plains was one thing, but the situation in mountainous regions was entirely different. Dwellers in the plains are always more subject to rules, Brownlow thought, and he saw them as having 'not the mountaineer's passionate love of freedom, nor the bulwarks of nature to befriend them'.[20]

British policies had failed to conciliate the Pathan tribesmen and in 1898 Brownlow commented that 'The Afridis will probably make some sort of submission before the spring, but we have no more conquered them than Napoleon conquered Russia in 1812'.[21] The same words apply as much in the 21st century as they did in the nineteenth.

Walter Calverley Beevor (1858-1927)

The son of John Beevor, Member of Parliament for Newark-on-Trent, Walter Calverley Beevor trained as a doctor in Edinburgh, qualifying MB and taking the MRCS in 1880.

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[16] Shadwell. *Lockhart's Advance*, 1898 (Note 15). p.88-107.
[17] Brownlow CH. *Stray Notes on Military Training and Khaki Warfare*. London: Women's Printing Society Ltd; c1913. https://babel.hathitrust.org/cgi/pt?id=mdp.39015027741894&seq=7 (accessed 8 Dec 2023).
[18] Brownlow. *Stray Notes*, c1913 (Note 17). p.42-46.
[19] Brownlow. *Stray Notes*, c1913 (Note 17). p.163-166.
[20] Brownlow. *Stray Notes*, c1913 (Note 17). p.43.
[21] Brownlow. *Stray Notes*, c1913 (Note 17). p.49.

He held junior posts at the Royal Portsmouth Hospital, Newark-on-Trent Hospital and Midland Counties Eye Infirmary. He entered the Army Medical Service as a surgeon on 2 August 1884 and was appointed medical officer of the Scots Guards in 1885.[22] Entry to the Army Medical Department was by a competitive examination held in London and Beevor was placed fourth. He would have a long and distinguished record of war service and was decorated and mentioned in despatches on many occasions.[23]

In 1885 he served on the Sudan expedition and received the Egyptian medal with clasp and Khedive's Bronze star. He became Surgeon-Major and received a special promotion in 1896 following the Ashanti Expedition and was mentioned in despatches. In 1897 he transferred to the Grenadier Guards, then to the Coldstream Guards in 1898, and in that same year returned to the Scots Guards. He served on the staff of the Duke of Connaught at Lord Curzon's Delhi Durbar in 1902, and on the staff of Lord Northcote, Governor of Bombay in 1903. He became Lieutenant-Colonel in 1904 and retired in August 1913.

In retirement Beevor was appointed Deputy Assistant Director of Medical Services to the North Midland Division Territorial Force. During the Great War he became Assistant Director of Medical Services, and in 1915 was mentioned in Field Marshal Lord French's despatch for gallant and distinguished service in the field. On 14 January 1916 Beevor was appointed Temporary Colonel, and Commander of the Most Honourable Order of the Bath for his services rendered in connection with the war. His service in the Great War was exceptional and he was mentioned in Sir Douglas Haig's despatch of 9 April 1917.

In 1890 Beevor married the daughter of Charles Taylor JP from Horton Manor in Slough, and the couple had a son and a daughter. Beevor died suddenly in London of heart failure on 6 February 1927, aged 68.

Beevor is recorded as the first to take and use an X-ray apparatus on active service as a regimental surgeon with the Coldstream Guards in the Tirah Campaign. He had been attached to the Brigade of Guards and had obtained permission to go out to India for a year where he joined a field hospital and was able to use his apparatus to great effect. It was for this service on the North-West Frontier of India that Beevor was mentioned in the despatch of General Sir William Lockhart in the *London Gazette* of 5 April 1898, being described as 'untiring in his efforts to prevent sickness'.[24]

Beevor examined 200 cases with X-rays on the Tirah plateau, later taking further radiographs in the hospital at Rawalpindi. His work is described in an interesting 1899 article 'The Röntgen Rays in Warfare' by Herbert Fyfe that appeared in the popular *Strand Magazine*.[25] Beevor had brought with him his personal Röntgen X-ray apparatus which he had purchased at his own expense from the firm AE Dean of Hatton Garden in London. The apparatus was the prototype of Dean's 'Portable or Field Service Type' of X-ray apparatus that later was supplied by the company to the British Army. It was securely packed in wooden boxes and consisted of an induction coil to produce the high-

[22] Anon. W.C. Beevor, C.B., C.M.G., Colonel, R.A.M.C., T.F. *British Medical Journal*. 1927; 1: 357.
[23] Anon. Medical Officers of the Malta Garrison, Colonel Walter Calverley Beevor, 1858-1927. http://www.maltaramc.com/regsurg/b/beevorwc.html (accessed 3 June 2023).
[24] *London Gazette*, No. 26954, 5 April 1898. p.2182.
[25] Fyfe HC. The Röntgen Rays in Warfare. *Strand Magazine*. 1899; 17: 777–783.

tension voltage that was needed to operate the vacuum tubes, a battery and fluorescent screens given a special coating of celanite to prevent scratching. In addition he had purchased three gas X-ray tubes from AC Cossor in Farringdon Street. Dean supplied Vulcanite cases for the tubes.

The apparatus was delicate and needed to be transported with considerable care. Somewhat surprisingly all three of the gas tubes survived the campaign intact. Beevor took with him three dozen glass photographic plates and found that they worked admirably through all the adverse conditions. He tried all possible means of transporting the apparatus in India, including mules, camels and wheeled vehicles, but concluded that human transport was best with the boxes slung between two poles and carried by two bearers.

One of the patients examined by Beevor was General Woodhouse (dates unknown). Woodhouse had displayed significant personal bravery under fire and was described as 'walking about in an almost solid stream of lead'. It is remarkable that he only received a leg wound, and he was taken to a tent in order for the bullet to be extracted. Whilst the procedure was being performed a group of Afridi fired into the tent putting some thirteen shots through the canvas. The General was reported as not being alarmed and eyewitnesses commented that he was as calm as if he had been in a London hospital. The surgical operation continued in spite of the continued fighting. Against medical advice General Woodhouse would not rest for long following the procedure and with an unhealed jagged wound he continued on horseback to Peshawar at the head of his brigade. Perhaps unsurprisingly the wound failed to heal and Woodhouse made his way to the base hospital at Rawalpindi where Beevor obtained the radiograph shown in Figure 1.

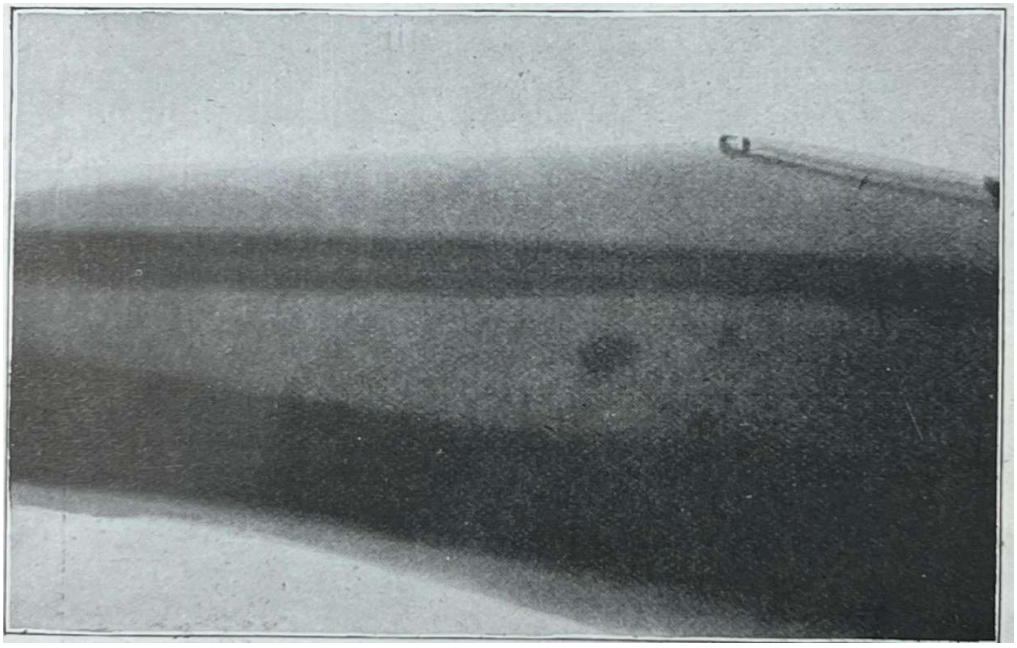

Figure 1. Bullet wound in the leg of General Woodhouse. From: Fyfe. The Röntgen Rays in Warfare, 1899 (Note 25).

This radiograph showed that a portion of the shot was indeed retained and was clearly visible between the tibia and fibula. The safety pin holding the dressing is clearly seen, the dressing itself being invisible. The retained bullet was successfully removed, and General Woodhouse recovered.

Beevor described a Gurkha who was shot in the back of his thigh during the first fight at Dargai, which is in the Malakand District of the north-western Khyber Pakhtunkhwa province of Pakistan and on the main highway from Peshawar to Swat, Dir and Chitral. The Dargai Heights, which were held by Afridi tribesmen during the Tirah Campaign, were successfully stormed by the Gordon Highlanders and the 2nd King Edward VII's Own Gurkha Rifles in an attack on 18 October 1897. The Heights, which commanded the line of advance, were captured without difficulty but abandoned owing to the absence of water. On 20 October the same positions were stormed with a loss of 199 of the British force who were killed or wounded. The Gurkha soldier's wound was probed by the surgeon but a bullet was not found; an exit wound was not visible and so there must have been a retained foreign body. The bullet might have been impossible to find until the swelling subsided, and the swelling might never have subsided. An amputation was therefore considered. Beevor found the exact position of the bullet which had traversed diagonally and downwards, ending next to the fibula (Figure 2).

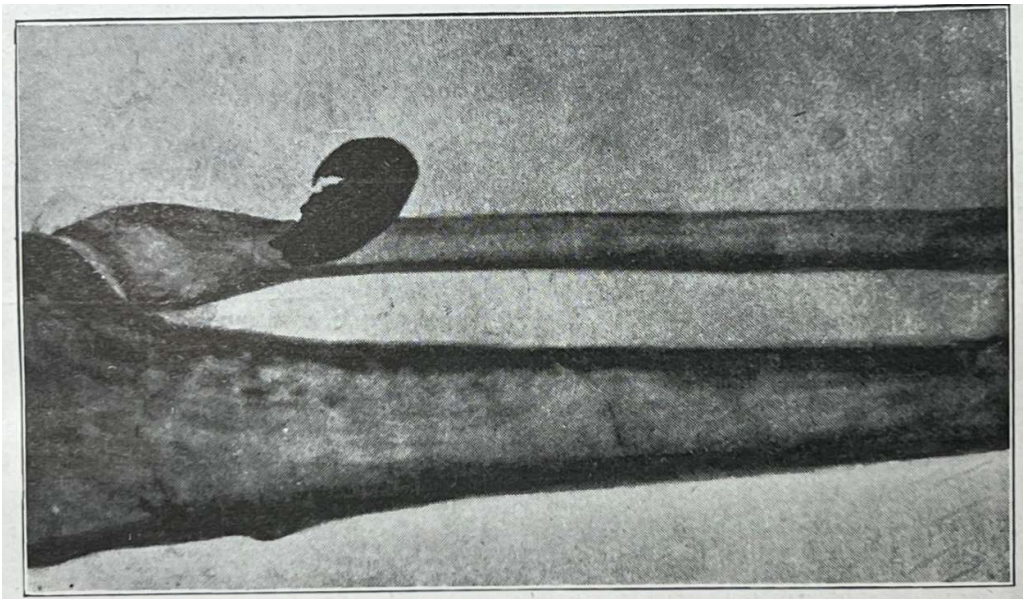

Figure 2. Bullet wound in the leg of a Gurkha. Taken in Dargai by Major Beevor. From: Fyfe. The Röntgen Rays in Warfare, 1899 (Note 25).

A cavalryman was shot in the arm on the inner aspect of his biceps. The wound was probed by an Indian Army surgeon without success. The patient was then sent on two months' sick leave, and on return applied for a pension, being a native soldier. He noted that he was unable to use his elbow and that in a certain position it locked. He found it difficult to use a lance and use of the arm was awkward. It was felt that he was

malingering and 'piling on the agony' and he was referred to Beevor who examined him with a fluorescent screen. Beevor instantly saw the bullet in front of the elbow joint, having passed down the biceps muscle to the tendon (Figure 3).

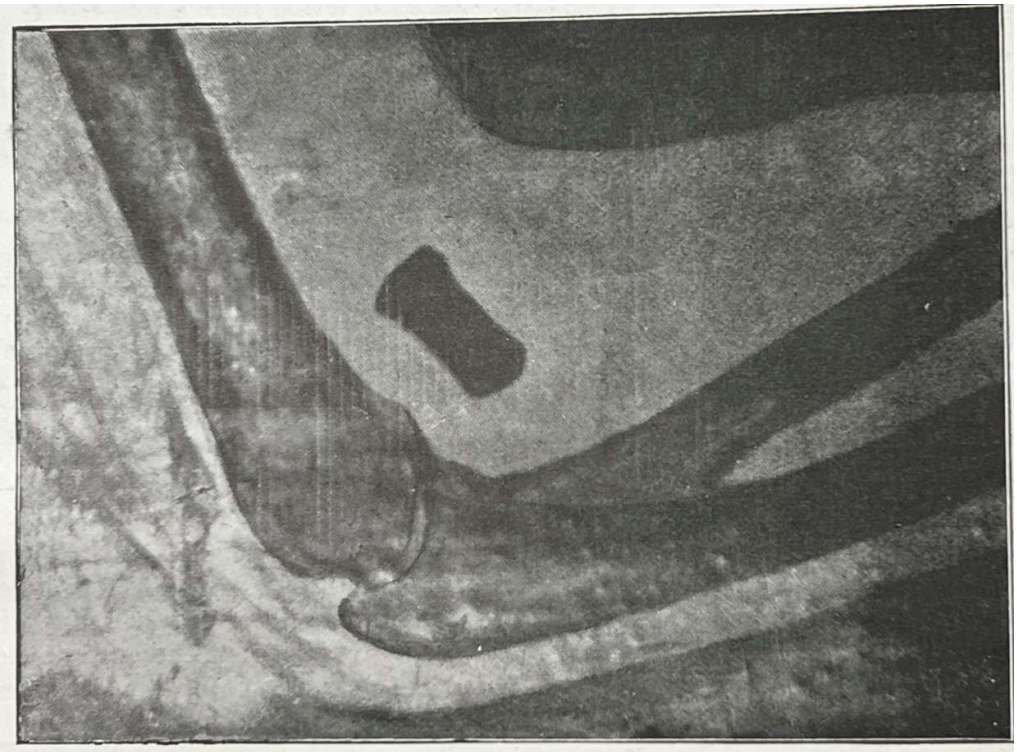

Figure 3. Bullet in elbow of native soldier. Taken by Major Beevor. From: Fyfe. The Röntgen Rays in Warfare, 1899 (Note 25).

The surgeon cut down on the bullet, and it took about an hour and a half to dissect the bullet from the fibrous tissue that had developed around the tendon. The cavalryman returned to duty and Beevor noted that he was 'probably more pleased at being cured than he would have been at getting his pension'.

A case was described of a soldier who was wearing a sheepskin coat and was hit by a bullet which when it entered the body took with it a complete envelope of sheepskin. The medical officer when exploring the wound felt only a soft object and did not think this was the bullet. The X-rays showed this was the covering of the bullet and it was removed without difficulty. The X-rays were also thought to be excellent when negative results were found and the presence of any foreign substance was excluded. This negative result avoided unnecessary exploration of a wound and Herbert Fyfe commented that 'the beneficent rays have prevented much suffering which would have occurred had probing been resorted to, and the operator may now dispense with the unsatisfactory and frequently not-too-well sterilized probe'. Fyfe quoted a doctor who had told him that 'As a death-dealing instrument, a dirty and unskilfully used probe has few equals, and many lives will be saved by rendering its use unnecessary'. And so the

use of X-rays was presented as modern science providing surgeons with an exact, painless and aseptic probe unlike older surgical instruments such as Délaton's probe and others of its type.[26]

Because of the long distance between the sites of conflict and the base hospitals the army surgeons carried out more surgical operations close to the front line. That Walter Beevor could take his primitive apparatus to such a remote location is quite remarkable and his technical skills should not be underestimated. Radiography, even at a fixed and well supplied location, was challenging during this early period. Beevor concluded that the use of X-rays alleviated the sufferings of many wounded men and allowed preservation of many limbs and that a Röntgen Ray apparatus 'would seem to be a very great addition to the medical equipment of a force'.[27]

Return to England

Upon his return to England in May 1898 Surgeon-Major Beevor was invited to make a presentation to the Royal United Services Institution (RUSI) about the recent use of the X-rays in warfare and his lecture on his experiences in the Tirah Campaign was found invaluable.[28] [29] He presented and described radiographs in different cases of bullet wounds where the use of the X-rays had been helpful. He presented the images of a sergeant who had been wounded in the instep by a bullet and all the fragments apart from one had been removed. The remaining fragment prevented the sergeant from walking, and a radiograph located it close to the heel. It was concluded that radiography alleviated the sufferings of many wounded men and enabled preservation of limbs. Beevor went on to maintain that it was now the duty of every civilised nation to supply its wounded in war with an X-ray apparatus located not only at base hospitals but also close at hand wherever fighting might be taking place.[30]

The Boer War

The Boer War (1899-1902), also known as the Second Boer War, the Anglo–Boer War and the South African War, was a conflict between the British Empire and the two Boer Republics concerning the British influence in Southern Africa. Limited campaigns had started in 1899 but initial preparations were quite inadequate and what was anticipated to be a brief conflict became a full-scale war. The medical arrangements became more

[26] Fyfe. The Röntgen Rays in Warfare, 1899 (Note 25).
[27] Beevor WC. 1898. The working of the Roentgen ray in warfare. *Journal of the Royal United Services Institution*. 1898; 42: 1152–1170. In: Bruwer AJ (ed). *Classic Descriptions in Diagnostic Roentgenology*, *Vol. 2.* Springfield, Ill: Charles C Thomas; 1964. p.1346–67.
[28] Beevor. The working of the Roentgen ray, 1898 (Note 27).
[29] The Duke of Wellington and others had established the RUSI in London in 1831. The RUSI is now a centre of policymaking and thinking on defence and security from the rise of the British Empire to the present day. See: The Royal United Services Institute, Our History. https://rusi.org/about/our-purpose/our-history (accessed 25 March 2023).
[30] Anon. X-rays in Warfare. *Archives of the Roentgen Ray*. 1898; 3: 1-2.

complex as the war progressed, with a system of fixed or general hospitals and moveable or field hospitals. The X-ray apparatus was now supplied to fixed general hospitals as part of the essential equipment for the campaign.[31] It should be remembered that both electrical and radiation protection were still primitive by current standards. The radiographic apparatus in the fixed hospitals enabled retained bullets to be detected and fractures to be diagnosed and then treated. The equipment was supplied with a dynamo to generate power needed for the batteries.

Stephen Bottomore in his 'Who's Who of Victorian Cinema' states that Beevor took an X-ray machine with him when the Scots Guards were sent to South Africa in November 1899.[32] There is little information about his radiographic work in South Africa and he made no further contribution to the radiological literature. Ted Burrows, the radiology historian, thought that Beevor did not take any part in the development of radiology following the Tirah Campaign and pursued his career as a conventional army surgeon in the Boer War and afterwards.[33] Radiology was rapidly developing as a speciality during this period and Beevor no doubt wanted to concentrate on his surgical interests. There is also no record of Beevor suffering from any of the harmful effects of X-rays which were commonly observed in radiology pioneers and this is further evidence for his limited further involvement in the new discipline.

Walter Beevor would have had considerable skills in photography and these would have been well known following his RUSI presentation. Before going to South Africa he was contacted by Robert William Paul (1869-1943), the pioneer of the British film industry, who lent him a film camera. Beevor was very successful with this film camera and was able to take a dozen films. These included the embarkation of the Scots Guards on 21 October 1899 and also their entry into Bloemfontein in the spring of 1900.[34] He filmed various scenes of troops, artillery and ambulances on the march, the crossing of the Vaal and Modder rivers, and in June 1900 he took a film of an observation balloon. Bottomore notes that Beevor's biggest scoop was in February 1900 when he filmed the captured Boer commander Pieter Arnoldus Cronjé as he was being driven off in a cart. Robert Paul's catalogue noted that 'as the cart passes the camera, Cronjé is seen to look out in astonishment at it'.[35]

For his meritorious service in South Africa Beevor was mentioned in the despatch of Lord Roberts dated 4 September 1901.[36] He remained in South Africa until 1902, being seconded to the South African Constabulary.

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[31] Bruce F. Experiences of X-ray work during the siege of Ladysmith. *Archives of the Roentgen Ray*. 1901; 5: 69–74.

[32] Bottomore S. Walter Calverley Beevor. British Military Doctor. Who's Who of Victorian Cinema. https://www.victorian-cinema.net/beevor (accessed 3 June 2023).

[33] Burrows. *Pioneers and Early Years,* 1986 (Note 3).

[34] Entry of the Scots' [sic] Guards into Bloemfontein. https://player.bfi.org.uk/free/film/watch-entry-of-the-scots-guards-into-bloemfontein-1900-online (accessed 3 June 2023).

[35] Bottomore. Walter Calverley Beevor (Note 32).

[36] *London Gazette*, No. 27353, 10 September 1901. p.5937.

Contemporary discussions

Following the discovery of X-rays there were discussions as to the most effective way to use radiography in military surgery. Several days after Surgeon-Major Beevor had made his presentation to the RUSI there was a discussion on 8 June 1898 at the House of Commons in Westminster.[37] William St John Fremantle Brodrick MP (1856-1942), who was then Under-Secretary of State for War, responded to questions from General Sir Baker Creed Russell (1837-1911) and Sir James Fergusson (1832-1907). At the time, Russell was General Officer Commanding Southern District and was based in Portsmouth, and Sir James Fergusson was Member of Parliament for Manchester North-East.

Russell asked Brodrick if the X-ray apparatus had been carried with the field army during the recent conflict in Egypt and whether there was a reason to believe that some lives of wounded officers and men might have been saved had the apparatus been available. Brodrick was also asked whether in future the Government would take steps to prevent any question of economy in transport to interfere with every precaution being taken to save valuable lives. Brodrick replied that the recently invented Röntgen ray apparatus was very difficult to adapt for field service and was not carried with the field army in the recent operations. From the Returns, that is the reports, the medical authorities had not considered that there was a single case in which life could have been saved by the use of X-rays. Two X-ray sets were then in Egypt, and one more was to be sent out shortly.

Two X-ray kits had been adapted as far as possible for field service, and one was for use in the base hospital. Fergusson asked that since 400 men had been wounded by bullets, would not the apparatus have been most useful in locating the bullets? Brodrick replied that the senior medical officer had gone carefully into the cases and had been unable to trace any single case in which the apparatus would have been especially useful, or in which it is clear that an operation would have been carried out more successfully by the use of the rays.

In the 'River War' in Egypt a British led army had been sent from Cairo to the Sudan against the Mahdists whom they defeated at Omdurman on 1 September 1898. As predicted from Beevor's experience radiography played a significant role in the management of casualties. Following the debate in parliament a decision was made to send X-ray apparatus under the charge of Surgeon-Major John Battersby (1879-1919).[38] The preliminary battle at Berber had already been fought. Battersby used the X-rays approximately 60 times at Abadieh near Berber on the upper Nile between July and October 1898. In twenty-one cases the bullet could neither be located nor its absence proven using traditional methods. In these patients the bullet was either found or its absence proved in twenty cases, and in the remaining case the patient was so ill with a bullet wound in the lung that radiography was considered inappropriate.

The German surgeon Hermann Küttner (1870-1932) of Tübingen was one of the great German researchers and a famous surgeon in the nineteenth century. He was

[37] Röntgen Rays. *Hansard.* HC Debate, 9 June 1898, Volume 58, Columns 1170-71.
[38] Battersby J. The present condition of the Roentgen rays in military surgery. *Archives of the Roentgen Ray*. 1899; 3: 89–91.

particularly interested in surgical disease of the brain and facial parts of the skull. Küttner was a brilliant surgeon and in 1900 he became Professor of Surgery at the University of Tübingen. He was a consultant to the German Red Cross and introduced X-ray apparatus into military surgery during the Græco-Turkish War.[39] In his report from the war Küttner concluded that the X-rays were of great use in war surgery but only recommended their use in fixed hospitals and those in fortresses and believed that their use in field hospitals was limited.[40]

In the editorial on 'X-rays in Warfare' in *Archives of the Roentgen Ray* of August 1898 the report of the principal medical officer of the United States troops fighting in Cuba was keenly anticipated, and it was published in 1900.[41] [42] In the Spanish–American War of 1898 there was a limited use of radiography and again this obviated the need for unnecessary probing of wounds. The larger American general hospitals and three hospital ships were supplied with radiographic apparatus. The American forces had felt that the use of radiography in the field was unnecessary because the bullet wounds rarely required immediate removal and it was also believed that, since aseptic surgery was not easy under field conditions if a radiograph could be obtained, it would only encourage surgeons to operate inappropriately.

By 1899 the British War Office was aware of the importance of equipping large military hospitals at home and abroad with X-ray equipment and officers of the Army Medical Services were being encouraged to acquire a thorough practical knowledge of radiography. The War Office was a department of the British Government responsible for the administration of the British Army between 1857 and 1964, when its functions were transferred to the newly formed Ministry of Defence.

Conclusion

Following the discovery of X-rays by Röntgen in 1895 military surgeons rapidly realised the value of radiography in military surgery. This view was soon implemented, and Beevor's work marked the introduction of field radiography units into the British Army. As military technology developed, so did the technology to treat war casualties. We owe a debt of gratitude to the pioneers who initiated military radiology, the need for which is sadly still very much with us.

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[39] Kanat A, Tsianaka E, Gasenzer ER, Drosos E. Some Interesting Points of Competition of X-Ray using during the Greco-Ottoman War in 1897 and Development of Neurosurgical Radiology: A Reminiscence. *Turkish Neurosurgery*. 2022; 32: 877-881.

[40] Küttner H. The importance of roentgen rays in war surgery based on experience in the Greco–Turkish war of 1897. In: Bruwer AJ (ed). *Classic Descriptions in Diagnostic Roentgenology*, *Vol. 2*. Springfield, Ill: Charles C Thomas, 1964. p.1337–45.

[41] Anon. X-rays in Warfare, 1898 (Note 30).

[42] Borden WC. *The Use of the Röntgen Ray by the Medical Department of the United States Army in the War with Spain (1898).* Washington, DC: Government Printing Office; 1900.

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Acknowledgements

No acknowledgements.

Sources of funding

The author did not receive any funding in support of this work.

Thomas AMK. Walter Calverley Beevor, the Tirah Campaign and the Origins of Military Radiology. *Topics in the History of Medicine.* 2023; 3: 63-76.