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The Acquisition of Radiological Technology at Kingston General Hospital: An Examination of Primary Documents

by

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Abstract

The acquisition of state-of-the-art equipment has been a recurrent budgetary issue for generations of hospital administrators. In recent decades, some of the most costly equipment acquisitions have been for radiological purposes. This paper looks at several notable cases of how decisions regarding equipment purchases in radiology were made by Kingston General Hospital (KGH), from December 1895 when Wilhelm Conrad Roentgen announced his discovery of x-rays to the present. KGH is an ideal subject for the study of radiological equipment acquisition, since it was one of the first hospitals in Canada to acquire an x-ray machine (in 1896) and a total body CT scanner (in 1977). In addition, KGH services a relatively small community with limited financial resources, which is a situation that is shared by many community hospitals across Canada. By studying primary sources held in the Kingston archives, this paper examines how decisions were made in the past with a view to exploring the tension between the lure of new technology and the inhibition of financial outlay at pivotal points in our past.

Introduction

On December 28th, 1895, the German physicist Wilhelm Conrad Roentgen (1845-1923) submitted his discovery of the "x" ray to the *Wuerzburg Physical-Medical Society* seeking expedited publication (Eisenberg, 1992). Within weeks, the news had spread around the world, and in early 1896, scientists throughout North America verified Roentgen's experiments. At the same time, Kingston General Hospital (KGH) appointed a new superintendent, Dr. James Third (1865-1925), who noticed the new technology. In late September 1896, KGH ordered an x-ray apparatus "of the most improved pattern," which arrived on October, 5th. Capt. John Bray Cochrane (1860-1946), an early pioneer of x-rays in Kingston, called it "a splendid one, modern and complete in every way" (Hayter, 1995). This machine was probably the first x-ray apparatus ordered by a Canadian hospital.

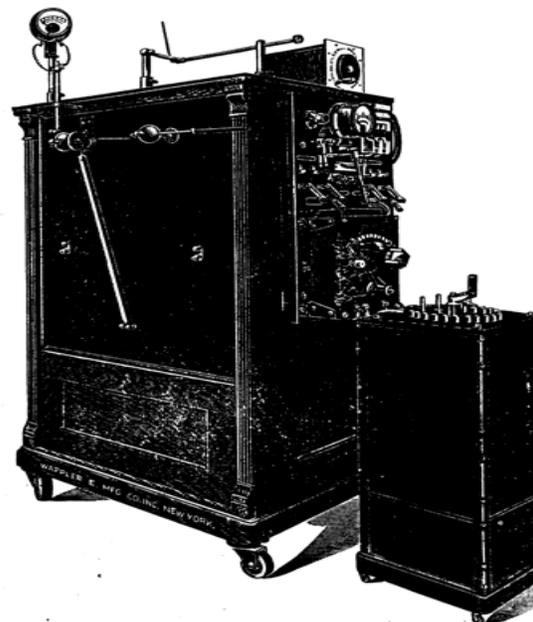
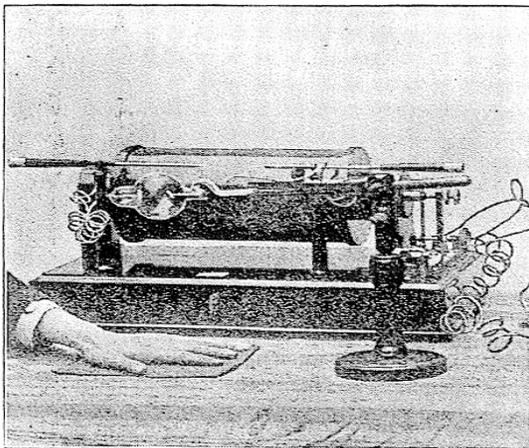
Although priority claims are controversial, a 1926 obituary for Dr. Third in the *Canadian Medical Association Journal* (CMAJ) stated that "[i]t was due to his effort and enterprise that the first x-ray equipment in Canada was installed [at KGH]" (ibidem). As well, archival copies of the *Daily British Whig* newspaper reveal that people came to KGH from as far as Galt, Ontario, and Buffalo, New York, for radiographic examinations, and other historians have noted x-ray equipment purchases at other hospitals to be much later: Toronto in 1900 and Halifax in 1904 (ibidem).

In this paper, I examine the decision-making process over purchasing several pieces of radiological equipment at key points in RGH's history. I will begin with the early record of x-ray machine acquisition, and end with its landmark acquisition of the full-body CT scanner in 1977. Some themes surrounding acquisition debates are perennial and relate to issues in the present day.

Early X-Ray Machines

The first x-ray machines were simple contraptions. Following Roentgen's discovery, physicists created simple x-ray apparatuses out of materials that were readily found in almost every physics laboratory of that era (Eisenberg, 1992). As time passed, physicians began to attribute their increasing success in treatment to medical technology and would no longer tolerate shoddy equipment. Manufacturers such as Reinhold Wappler of New York responded by providing machines that were more sophisticated and specialized for medical use, and correspondingly, the cost of acquiring them became higher (Davis, 1981). The records surrounding the historic purchase of the x-ray machine in 1896 are unfortunately scant; however, the minutes of the KGH management committee preserved in the hospital's archives track subsequent acquisitions of x-ray technology.

The original x-ray machine (shown in Figure 1a), acquired in 1896, served as the sole x-ray apparatus at KGH until a new machine was bought in December of 1909. Dr. Third operated the original machine until his resignation in July 1900. The medical staff recommended that Dr. Third remain in control, but his successor Dr. Haig took over and remained in control even after Dr. Third re-joined the staff in December 1900 (Angus, 1974). His action suggests that the x-ray was regarded as prestigious; several decades later, similar jockeying for the privilege of controlling new technology would re-surface with the acquisition of the CT scanner.



X-RAY MACHINE
PRESENTED TO THE HOSPITAL BY NAPANEE WOMAN'S AID SOCIETY.

Figure 1: (a) The first x-ray machine, acquired by Kingston General Hospital on October, 5th, 1896 (Kingston Medical Quarterly, 1898). (b) The Wappler machine that was purchased by Kingston General Hospital in April 1914 (Kingston General Hospital Annual Report, 1914). Photo credits: Kingston General Hospital Archives.

In August 1908, a new superintendent, Dr. H.A. Boyce, sympathized with the doctors' desires for better facilities (Angus, 1974). Although funds were limited, a Scheidel Western x-ray machine (shown in Figure 1b) costing \$850 was purchased in December of 1909 (KGH, 1909). Four and a half years later, in April 1914, the hospital ordered a Wappler x-ray machine costing \$1200 (KGH, 1914). In both 1909 and 1914, the Napanee Woman's Aid Society (one of the precursors to the KGH Auxiliary) contributed funds from fundraising efforts to make the acquisitions possible. The appendix to this paper shows the deliberations surrounding the two acquisitions recorded in the minutes of the hospital's Management Committee.

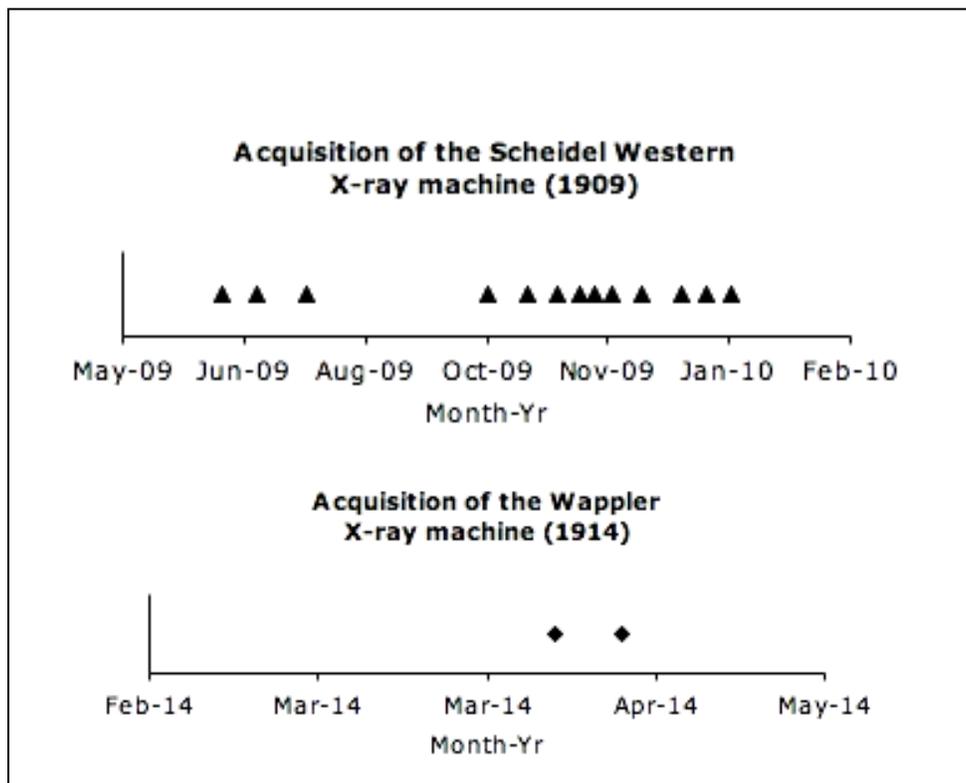


Figure 2: Graphical representation of the number of Management Committee meetings at which the acquisition of the x-ray was discussed. Data generated from the ledgers of the Management Committee minutes, held at the Kingston General Hospital Archives.

Separated by only fifty-two months, striking differences appeared in the amount of discussion over the acquisitions. The x-ray was quickly becoming a mainstay of hospital care; much less debate greeted the later but more costly purchase. The deliberations

over the Scheidel Western x-ray machine in 1909 took more than six months, in thirteen separate meetings; the 1914 purchase took about one week, at only two meetings.

By 1920, when another x-ray machine was installed in the basement of Empire Wing, x-ray had become a much more commonplace technology. Future acquisitions of x-ray apparatuses appeared in Annual Reports; however, discussion at top-level committees seemed minimal. Great expenditures for diagnostic equipment had become routine.

The Arrival of Computed Tomography

Let us now move ahead half a century: Many scientists had experimented with the concept of tomography in the first half of the 20th century, but it was not until late 1972 that computed tomography (CT), developed by British engineer Sir. Godfrey Hounsfield (1919-2004), was introduced at the annual meeting of the Radiological Society of North America (Eisenberg, 1992). The medical community was abuzz with excitement.

Once again, KGH achieved another Canadian first when, in August 1977, it purchased the General Electric total body scanner. This machine was the first in Canada that would take cross sectional images of both the head and the body (Angus, 1994).

This decision required significant planning and government involvement. On April 15th, 1976, Ontario's Ministry of Health wrote to the executive director of KGH to approve the acquisition and outline the conditions required for government support. The capital costs would come from KGH but allowances for depreciation and operation would be made. The Ministry recommended that the machine be able image both the head and the body, making it the first CT scanner in Canada to have such capabilities (MOH, 1976).

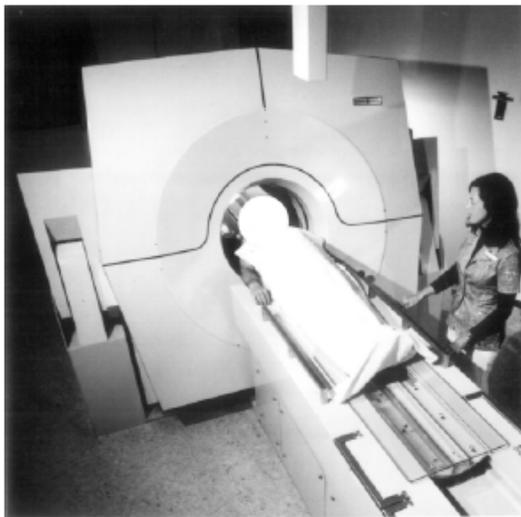


Figure 3: The General Electric Total Body Scanner acquired by Kingston General Hospital in 1977. Patient identity has been obscured for confidentiality purposes. Photo from KGH Scanning Equipment File D25, held in the Kingston General Hospital Archives.

The landscape of medical management had clearly changed since the turn of the century when KGH had acquired its first pieces of equipment for radiology. The *Hospital Insurance and Diagnostic Services Act* (1957) and the *Medical Care Act* (1966) had given the government a much larger role in determining what pieces of equipment the individual hospital could acquire. However, as in the past, capital costs remained the responsibility of the hospital; only operational costs could be funded by the government

(MOH, 1976). Just as in 1909 and 1914, when the Napanee Woman's Aid Society had donated the money needed to buy some of the initial x-ray machines, local fundraising efforts were critical to the acquisition of the CT.

Because the government wanted the CT to serve all Eastern Ontario hospitals, it offered some funding for operational costs to spare KGH's operating budget (MOH, 1976). With this government support, the acquisition was speedily carried out; by August 1977, the CT was installed and in operation (KGH, 1978). In contrast, a little over a decade later, when several other hospitals in the Eastern Ontario region had already acquired MRI, the government was far less supportive and KGH's acquisition of MRI was greatly delayed (George, 1987).

The CT scanner enjoyed an enthusiastic reception, and in the first seven months, 1,242 scans were performed (KGH, 1978). The government's support was limited to one shift a day for five days, but the hospital rearranged priorities to avoid any significant waiting list (KGH, 1978). However, by 1980, the annual number of scans had increased to 3,454 (a 54% increase over its first-year usage), and in July 1981, CT scans required a four-week wait (KGHDR, 1981; McKinnon, 1981). Guidelines for the operation of the CT scanner recommended no more than 2,500 scans per year, so by 1981, a second scanner was needed (McKinnon, 1981). However, the government was not interested in funding another scanner, and KGH waited until March 1993 for another one, long after even the government's own predicted five-year life expectancy for the first scanner (KGH, 1993).

The disadvantage of having only one machine was clearly evident when repairs were needed. In 1982, from mid-September to early October, the CT scanner was moved for repairs. As a stop-gap measure, a temporary CT scanner inside a trailer was ordered and used. Both inconvenient and costly, the "CT van" prevented the kind of complete disruption of imaging services that had been reported when the first x-ray machine was being repaired in May 1901 (AMI, 1982; McKinnon, 1982; Angus, 1974).

Looking Beyond X-Rays and Toward the 21st Century

After the acquisition of the CT in 1977, the years that followed were challenging for Diagnostic Radiology at KGH. Although it had been clear by the early 1980s that a second CT scanner was needed, the hospital was unable to raise the funds from local sources or the government, which maintained that all capital costs must come from the hospitals themselves. With this rapidly-developing technology, the department's equipment quickly became outdated. Lack of cutting-edge technology and the apparent indifference about the problem made it difficult to attract specialists to the department. One prospective radiologist complained, "Without such equipment, my training would not be required in Kingston and I doubt that you would be able to attract any neuroradiologist in Canada" (Scott, 1985).

In addition, the scarce equipment available at KGH was being over-utilized to the detriment of the already-aging equipment. In 1988, the CT Utilization Committee argued that "[w]hile it appears that the most cost effective method of operating expensive equipment is to run it twenty-four hours a day, 365 [days] a year, in actual practice this might prove to be detrimental. By using the unit twenty-four hours a day, the life span is shortened accordingly and replacement will have to be scheduled earlier. With an aging

scanner such as at KGH, increasing hours of operation will certainly increase downtime” (CTUC, 1988).

In 1985, an external review of the radiology department led by Dr. Lewis S. Carey identified serious deficiencies and the need to replace equipment with new imaging technology in order to maintain KGH’s status as an academic facility. One of his recommendations was the development of a “five-year plan for the regular replacement of existing equipment and for the introduction of new imaging technology” (Carey, 1985). The Radiology Modernization Plan committee was formed in 1989 to identify necessary changes in the department’s infrastructure. Its success was mirrored in the acquisition of several big-ticket items between 1992 and 1994: another CT scanner and an MRI machine, two items that had been discussed for almost a decade. Dr. Carey also emphasized the importance of effective communication between the Hospital’s Board of Directors and the radiology department:

To provide the money for new tools and for the efficient management of the department will require a close liaison between the Chairman of Radiology, the hospital administration and the Board. I suspect the Board of Directors is not fully aware of the developments taking place in the specialty and of the financial needs of the Department of Radiology. I suggest this is so because [the head of the department] has been asked on only one occasion to address the Board of Directors
(Carey, 1985).

Today, KGH’s radiology department is a vibrant academic and tertiary care centre with highly-specialized staff and a strong cohort of residents. Perhaps the happy situation is owing to some of the drastic actions taken in the late 1980s and early 1990s. Nevertheless, challenges persist in the arena of diagnostic imaging not only for Kingston General Hospital but also for hospitals across Canada. With the constant growth of imaging, the pressure to make cost-effective decisions has never been greater. In the early 20th century, decision-makers simply asked, “Will this machine help patients?” and “Can we afford it?”, but at the dawn of the 21st century, we still face many variations of those two fundamental but perennial questions.

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Abbreviations

KGH: Kingston General Hospital
KGHDR: Kingston General Hospital Department of Radiology
CTUC: KGH CT Utilization Committee
MOH: Ministry of Health (Ontario)

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