

Management of patients under general anesthesia with *mafutsu-san* in Hanaoka-style surgery: comparisons of illustrations from *Geka-Kihai-Zufu* with descriptions from *Mafutsuto-Ron* and *Yohka-Hiroku*

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Abstract

Introduction Seishu Hanaoka (1760–1835) left behind no books that he himself had written. This is why many aspects of Hanaoka-style general anesthesia using a mixture of herbal extracts, which he called *mafutsu-san*, remain unknown. We are able to learn about this technique today because there are several descriptions of it in books written by his students, such as *Mafutsuto-Ron* (“Treatise on *Mafutsuto*”) by Gendai Kamata (1794–1854) and *Yohka-Hiroku* (“Secret Records of Surgery”) by Gencho Homma (1804–1872). On the other hand, *Geka-Kihai-Zufu* (“Illustrations of Surgical Cases”), a surgical textbook, by Gendai Kamata, containing one of the oldest illustrations of general anesthesia published in 1840, was recently rediscovered (2011). For the first time, this book revealed, in the form of a picture image, the actual circumstances of Hanaoka-style general anesthesia.

Methods We therefore compared the descriptions of general anesthesia featured in these three documents, and thereby investigated the actual anesthetic management and the procedures used.

Results and conclusions We found that the circumstances under which Hanaoka-style general anesthesia, using fabrics and futon mattresses, as well as blindfolding and constraining the patient’s body during surgery, were exactly as described in *Mafutsuto-Ron* and *Yohka-Hiroku*. In addition, besides a surgeon conducting an operation, there was a physician who observed the patient’s general condition. Gendai Kamata, the author of *Geka-Kihai-Zufu*, is believed to have recognized the importance of anesthetic care of surgical patients.

Keywords History · Genndai Kamada · Seisyu Hanaoka · Mafutsutoron · Gekakihazufu

Introduction

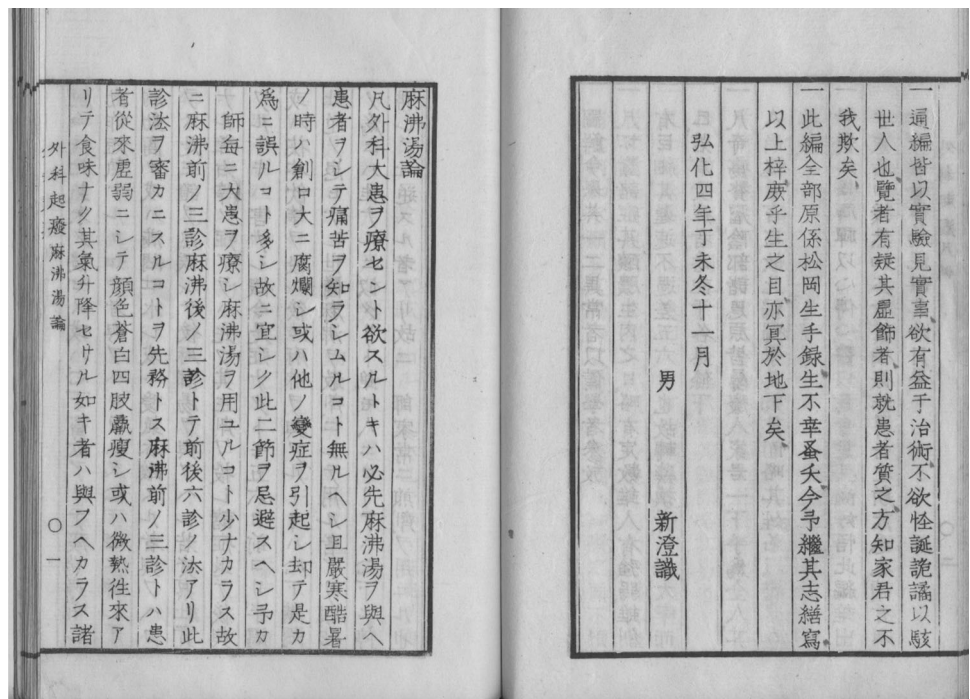
Hanaoka Seishu is famous for having performed surgery under general anesthesia using a mixture of herbal extracts. However, since he left behind no books that he himself had written, many aspects of Hanaoka-style general anesthesia using a mixture of herbal extracts, which he called *mafutsu-san*, remain unknown. We are able to learn about this technique today because there are several descriptions of it in books written by his students, such as *Mafutsuto-Ron* (“Treatise on *Mafutsu-san*”) [1] by Gendai Kamata (1794–1854) and *Yohka-Hiroku* (“Secret Records of Surgery”) [2] by Gencho Homma (1804–1872). In addition, *Geka-Kihai-Zufu* (“Illustrations of Surgical Cases”) [3], a text written in 1837, was recently rediscovered (2011). This book is the first to reveal, in the form of a pictorial image, the actual circumstances of Hanaoka-style general anesthesia. We therefore compared these three documents, and thereby identified the actual anesthetic management and the procedures used.

Methods

We compared the following three documents and examined the actual state and circumstances of Hanaoka-style general anesthesia: (1) descriptions of anesthesia featured in *Mafutsuto-Ron* written in 1839, (2) descriptions of anesthesia featured in *Yohka-Hiroku* written in 1837, and (3) illustrations depicting the entire scene in which general anesthesia was administered, as featured in *Geka-Kihai-Zufu* published in 1840.

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Fig. 1 The first page of *Mafutsuto-Ron*. The first chapter of *Geka-Kihai*



Results

Descriptions in *Mafutsuto-Ron* (1)

Mafutsuto-Ron comprises 10 pages of 80 sentences using approximately 2,500 Japanese and Chinese characters. Because it used the writing style prevalent in the nineteenth century, there are no paragraphs or punctuation marks (Fig. 1). It gives concrete, clinical experience-based descriptions of the indications and contraindications for anesthesia, the method of administering anesthesia using *mafutsuto* as well as signs of appropriate anesthetic depth, and management methods to be applied during and after surgery, among other topics. It is written so that even those who have no opportunities to actually perform general anesthesia using *mafutsuto* can do so using this herbal mixture [4]. Below is an excerpt from descriptions of the circumstances of general anesthesia, as featured in *Mafutsuto-Ron*:

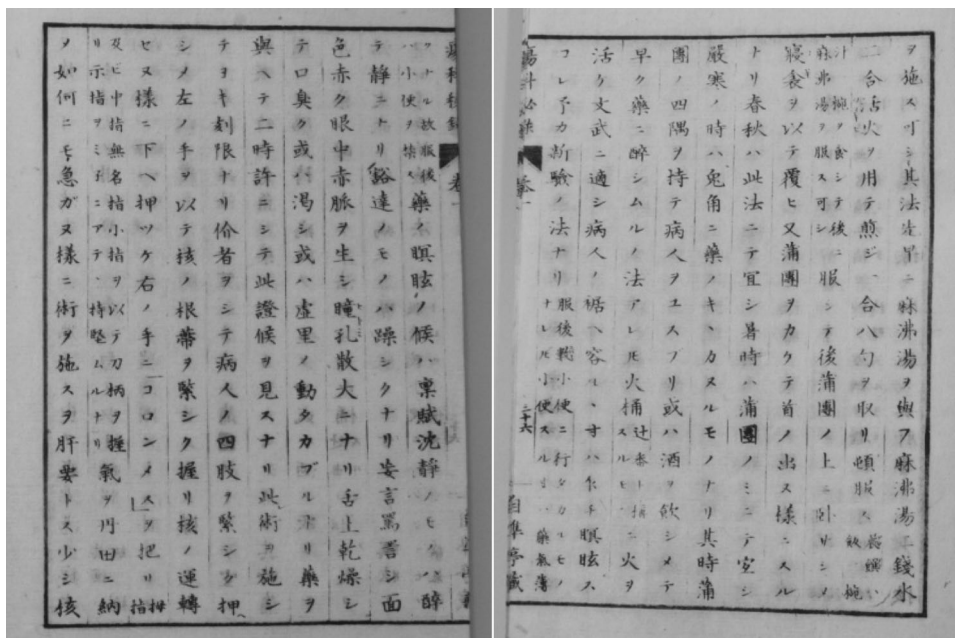
“About one hour after having *mafutsuto* administered, patients manifest a) pollakiuria and tachycardia, b) increased heart rate and xerochilia, and c) dilation of the pupils. If patients present all three symptoms, they may be considered to have entered an anesthetized state. After administering *mafutsuto*, have the patient to lie down in a private room and create a quiet environment. Some patients may sleep, while others may not sleep at all, and yet others may talk deliriously. However, they all gradually fall into an anesthetized state. When performing surgery, it is

important to blindfold the patients, and constrain their hands and legs securely with a rope, etc. This is because, even if they are anesthetized, they can become convinced that there is pain, or be overcome by fear after seeing the surgical equipment, then squirming and moving their hands and legs violently. Some may also come out of anesthesia sooner than expected, so it is a good idea to perform surgery a little earlier than planned. Before surgery, have all the necessary items ready, including various surgical devices, ointments, chicken eggs, cotton cloth, bandages, etc., and perform surgery, making sure not to be careless with the preparations. Patients may vocalize during treatment that uses *mafutsuto* because of pain, or may engage in normal conversation. However, these are delirious utterances made under anesthesia, so there is no need to answer or deal with them in any way. Even in these cases, by confirming the three symptoms after administration of *mafutsuto*, it is possible to verify the authenticity of anesthesia.”

Descriptions in *Yohka-Hiroku* (2)

Unlike *Mafutsuto-Ron*, *Yohka-Hiroku* does not mention items regarding general anesthesia only. Instead, descriptions of anesthesia are found in the section on breast cancer in volume 1 (Fig. 2). There are ten sentences in 2 pages using approximately 300 Japanese and Chinese characters in total. Descriptions of the circumstances of general anesthesia are presented below:

Fig. 2 The 94th and 95th pages of *Yohka-Hiroku* vol 1, including the descriptions of general anesthesia using *mafutsu-san*



“After administering mafutsuto, have the patient lie on a futon mattress, cover the body with bedding and sheets, and have only the neck and head visible. Some patients may wish to urinate after receiving mafutsuto. However, the effects of anesthesia are attenuated by urination, so do not allow patients to urinate. There is the person who is hard to anesthetize. It is effective in these people when we do it as follows, putting it in futon mattress and shake it, making liquor drunk, putting a kotatsu in futon mattress and warm it. These are the new methods that I thought out. If the anesthesia begins to work, patients who are usually quiet become even quieter; while those who are lively become noisy and talk deliriously. However, they gradually fall into an anesthetized state.”

Yohka-Hiroku can be read in many libraries in Japan.

Descriptions in *Geka-Kihai-Zufu* (3)

Geka-Kihai-Zufu mainly shows illustrations of the local site before and after surgery. However, four figures (Figs. 2, 10, 11, and 48: Figs. 3, 4, 5, 6 of this work, respectively) show scenes of surgery being performed under general anesthesia. Of these, three scenes depict a patient being blindfolded; in one scene a patient's body is being covered with bedding; three scenes show both of a patient's hands being constrained by other people or with a cloth; and in two scenes an individual, believed to be an assistant, is taking the patient's pulse. *Geka-Kihai-Zufu* is very rare book that can only be read in one library in Aichi Prefecture.

Discussion

Seishu Hanaoka left behind no books that he himself had written. Hanaoka-style anesthesia was passed down to later generations by Gendai Kamata and Gencho Homma. The Hanaoka style of general anesthesia is still known about due to the books they wrote: *Mafutsuto-Ron* and *Yohka-Hiroku*.

Gencho's anesthetic technique is believed to be based on the Hanaoka method, and he added numerous unique innovations to the basic technique [5]. However, the details are unclear since there are only 300 characters for the descriptions of anesthesia. In contrast, Matsuoka's *Mafutsuto-Ron* has approximately 2,500 text characters that concretely describe the method of managing general anesthesia using *mafutsuto*. It is written so that even those who have no opportunities to actually perform general anesthesia using *mafutsuto* can do so using this herbal mixture. In terms of explaining the Hanaoka-style anesthesia in detail, *Mafutsuto-Ron* is believed to be superior to *Yohka-Hiroku* [4, 5]. However, it is unclear what the constraining of the limbs and the blindfolding described in both books were actually like. The four illustrations of *Geka-Kihai-Zufu* discovered on this occasion provide a panoramic view of general anesthesia being performed. The actual circumstances of the procedure during Hanaoka-style general anesthesia can be seen as a pictorial image; the images clearly show what blindfolding with a cloth looked like, and how the cloth and bedding were used to constrain the patients' limbs [6, 7]. In the two illustrations included in *Geka-Kihai-Zufu*, in addition to several surgeons, we see one physician in each picture who is

Fig. 3 *Geka-Kihai-Zufu*, Fig. 2 (pp. 4–5). Resection of a breast cancer under general anesthesia using *mafutsu-san*



Fig. 4 *Geka-Kihai-Zufu*, Fig. 10 (pp. 25–6). Amputation of a leg under general anesthesia using *mafutsu-san*



observing the patients' overall bodily conditions without looking at the operative field. These individuals appear to be taking the patients' pulses. They are physicians, the

specialized practitioners in charge of anesthesia, who monitor the patients' overall bodily states. Because the two figures are wearing similar clothing and are both bald, they

Fig. 5 *Geka-Kihai-Zufu*, Fig. 11 (pp. 27–8). Resection of a testicular tumor under general anesthesia using *mafutsu-san*



Fig. 6 *Geka-Kihai-Zufu*, Fig. 48 (pp. 77–8). Resection of an intrauterine hematoma under general anesthesia using *mafutsu-san*



are believed to be the same person [6, 7]. Since Gendai is performing the operation as a surgeon, this individual is believed to be Matsuoka, a student of Gendai who had an exceptional talent for giving anesthetic [8, 9]. Matsuoka was a physician who had worked for Iyo Yoshida Domain during the feudal period. After studying at Hanaoka Shunrinken Medical School, he became Gendai's leading

disciple, and played the most central role in Gendai's literary works [8, 9]. During the 1830s, Gendai appointed Matsuoka as one of his physicians who knew anesthetic care and performed a variety of surgical procedures in fields including general surgery, pediatric surgery, plastic surgery, oral surgery, orthopedic surgery, urology, gynecology, and so on. Gendai Kamata, who wrote *Geka-Kihai-*

Zufu, is believed to have recognized the importance of anesthetic care of surgical patients.

Conclusion

The circumstances of Hanaoka-style general anesthesia, as described in books such as *Mafutsuto-Ron*, were revealed for the first time in the form of illustrations in *Geka-Kihai-Zufu*. The pictures in this text illustrate patients being blindfolded and restrained, corresponding exactly to the descriptions in *Mafutsuto-Ron* and *Yohka-Hiroku*. In addition to a surgeon, the illustrations show a physician who is observing the patient's overall bodily condition, indicating that Gendai Kamata, who wrote *Geka-Kihai-Zufu*, recognized the importance of anesthetic care of surgical patients.

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