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A case report of human skeletal remains performed "Tameshi-giri (test cutting with a Japanese sword) "

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Abstract This is the report of some sharp force wounds in skeletal remains excavated from the burial of the Edo era. Two individuals were contained, a young-adult male individual was almost all bones, and another young male individual was restricted to a part of trunk bones. Some vertebrae and rib bones of both individual were cut off completely in horizontal direction at least seven times for young-adult individual and five times for young individual, respectively. These unique wounds must be made with "tameshi-giri" procedure that was the performance test of a Japanese sword and as well as a part of legitimate criminal justice procedure.
Key word : skeletal trauma, Japanese sword, cut mark, Tameshi-giri

Introduction

This paper reports some discriminating sharp force wounds observed in the skeletons of the Edo period. There are some reports of the sharp force wounds found among ancient Japanese (Suzuki, 1956; Kawagoe, 1975; Morimoto, 1987; Morimoto and Hirata, 1992; Hirata et al., 2004; Saiki et al., 2006; Nagaoka and Abe, 2007; Dodo et al., 2008). These traumas were thought to be inflicted with Japanese swords under a conflict or an execution. However, the position and direction of these traumas reported here were very unusual, and different from any of those described in the previous studies.

Material and Methods

The skeletal remains with unique sharp force wounds are stored at the National Museum of Nature and Science as "No. 16" of the Yushima 4-chome burial which was excavated at 12-8 4-chome Yushima, Bunkyo-ku, Tokyo on Feburary, 1988. The number of excavated skeletal remains in this burial was up to 46. Although there is no published report, it is recorded in the museum note at receiving these specimens that this burial is adjacent to the Yushima Muenzaka burial where many skeletal individuals were excavated accompanying with cultural items of the Edo era (Kawagoe, 1957).

They were located where there had once been the cemetery of the "Kouan-ji" temple during the Edo era. The preservation of "No. 16" is good and the minimum number of these skeletal remains is 2. Almost all bones except for some vertebrae and ribs were thought to be belonged to a young-adult individual (*No. 16-1*) because all articulations matched properly. The remained bones were thought to be of a young individual (*No. 16-2*) around mid-teenager because of unfused vertebral ring epiphyses of thoracic and lumbar vertebrae, unfused head epiphyses of ribs, and duplication of lumbar vertebrae among "No. 16" of the Yushima 4-chome burial.

Ghacon et al. (2008) classified a sharp force wound into 5 categories on the basis of the morphology of defects or fracture patterns as follows; 1) *Cut mark*: This is a shallow linear striation that interrupt the continuity of the surface of

a bone and generally have a V-shaped cross section. 2) *Peeling or shaved defect*: Bone fragment is lifted or peeled from the surface when the instrument hits a bone at an angle. 3) *Point insertion or notched defect*: This is a penetrating injury in which the tip of the instrument is drawn vertical to the surface of the bone. They are generally deep and show an elongated, triangular, or V-shaped cross section. 4) *Slot fracture*: This is characterized by a wide groove with an associated or concentric fracture. 5) *Chop mark*: This is characterized by fractures and defects that result when the instrument attacks a bone and the blade is removed from the bone. In this paper, another category was added in classification of the sharp force wound as "*Cut-off mark*", which is characterized by completely cut off a bone and only linear and smooth facet on the bone, so that it is impossible even whether the instrument is double or single edged. In this paper, these classifications were adopted.

Furthermore, the direction of each sharp force wound was determined simply as "horizontal", "oblique", and "vertical", which respectively mean "a smooth facet of a wound ranges among 0–30 (or 330–360) degrees from horizontal plane of each bone", "a smooth facet of a wound angles among 30–60 (or 300–330) degrees from horizontal plane of each bone", and a smooth facet of a wound angled among 60–90 (or 270–300) degrees from horizontal plane of each bone". These degrees were counted as putting a protractor on a margin of a wound with holding a bone in its horizontal plane not in the anatomical horizontal plane of a body. For example, a rib was put its upper margin of a rib's body upside down on a flat table for taking an angle of a wound because of the difficulty of reconstruction of the anatomical horizontal plane of ribs. Thus the evaluated directions of sharp force wounds in this paper were not strict.

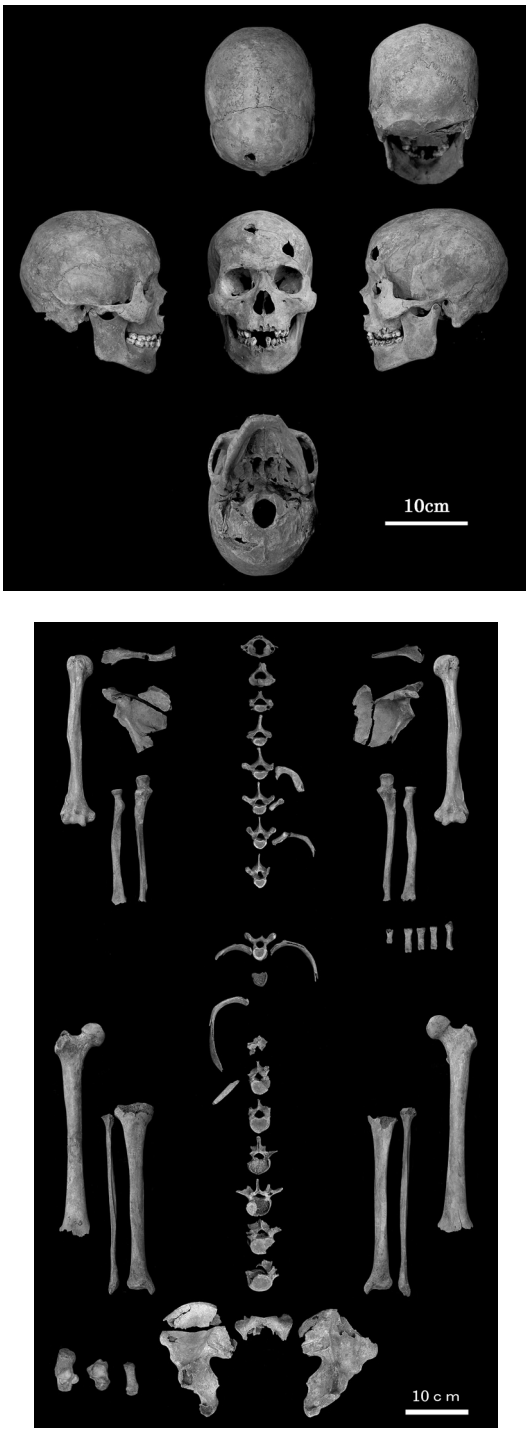

Fig. 1. Preservation of "No. 16-1" individuals.

"No. 16-1"

The preservation stage of this individual is presented in Fig. 1. The sex of this individual

Table 1. Sharp force wounds apparently identified in "No.16" of Yushima 4-chome site.

	Number	*Position*	*Classification*	*Direction*	*Figure*
"No. 16-1"	1	right side of frontal bone	Notched defect	Horizontal	Fig. 2
	2	left side of frontal bone	Notched defect	Horizontal	Fig. 2
	3	occipital bone	Cut mark	Horizontal	Fig. 3
	4	posterior arc of axis	Cut-off mark	Horizontal	Fig. 3
	5	posterior arc of 7th cervical vertebra	Cut mark	Horizontal	Fig. 4
	6	midshaft of left clavicle	Cut-off mark	Vertical	Fig. 5
	7	midshaft of right clavicle (medial)	Cut-off mark	Oblique	Fig. 5
	8	midshaft of right clavicle (lateral)	Cut-off mark	Horizontal	Fig. 5
	9	medial part of left scapula	Cut-off mark	Vertical	Fig. 5
	10	lower part of left scapula	Cut-off mark	Horizontal	Fig. 5
	11	upper part of right scapula	Cut-off mark	Oblique	Fig. 5
	12	lower part of right scapula (cranial)	Cut mark	Horizontal	Fig. 5
	13	lower part of right scapula (caudal)	Cut-off mark	Horizontal	Fig. 5
	14	neck of left 1st rib	Cut-off mark	Vertical	Fig. 6
	15	neck of left 2nd rib	Cut-off mark	Vertical	Fig. 6
	16	neck of left 4th rib	Cut-off mark	Vertical	Fig. 6
	17	lower part of 6th thoracic vertebra	Cut-off mark	Horizontal	Fig. 7
	18	upper part of left 6th rib	Cut-off mark	Horizontal	Fig. 7
	19	lower part of right 6th rib	Cut-off mark	Horizontal	Fig. 7
	20	midshaft of right 8th rib (proximal)	Cut-off mark	Oblique	Fig. 7
	21	midshaft of right 8th rib (distal)	Cut-off mark	Oblique	Fig. 7
	22	upper part of 10th thoracic vertebra	Cut-off mark	Horizontal	Fig. 7
	23	midshaft of right 11th rib	Cut-off mark	Oblique	Fig. 7
	24	lower part of 12th thoracic vertebra	Cut-off mark	Horizontal	Fig. 7
	25	upper part of 2nd lumbar vertebra	Cut-off mark	Horizontal	Fig. 8
	26	lower part of 3rd lumbar vertebra	Cut-off mark	Horizontal	Fig. 8
	27	upper part of 4th lumbar vertebra	Cut-off mark	Horizontal	Fig. 8
	28	lower and left part of 5th lumbar vertebra	Cut-off mark	Oblique	Fig. 8
	29	upper part of right innominate bone	Cut-off mark	Horizontal	Fig. 9
"No. 16-2"	30	upper part of 7th thoracic vertebra	Cut-off mark	Horizontal	Fig. 12
	31	lower part of 7th thoracic vertebra	Cut-off mark	Horizontal	Fig. 12
	32	midshaft of left 7th rib (proximal)	Cut-off mark	Oblique	Fig. 12
	33	midshaft of left 7th rib (distal)	Cut-off mark	Oblique	Fig. 12
	34	midshaft of right 7th rib (proximal)	Cut-off mark	Oblique	Fig. 12
	35	midshaft of right 7th rib (distal)	Cut-off mark	Oblique	Fig. 12
	36	lower part of 1st lumbar vertebra	Cut-off mark	Horizontal	Fig. 12
	37	upper part of 4th lumbar vertebra	Cut-off mark	Horizontal	Fig. 12
	38	lower part of 4th lumbar vertebra	Cut-off mark	Horizontal	Fig. 12

was diagnosed as a male on basis of its narrow greater sciatic notch, massive supraorbital ridge and mastoid process (Bruzek, 2002; Sakaue and Adachi, 2009). His age-at-death was estimated around 25 years old on the basis of the morphologies of the pubic symphysis and auricular facet (Lovejoy et al., 1985; Sakaue, 2006).

All apparent sharp force wounds of this individual were listed in Table 1. Three kinds of wounds were identified as follows.

1) Notched defects

In frontal bone there were two holes (No. 1 and No. 2 in Table 1) whose sizes were 22.5 by 17.5 mm and 22.4 by 11.6 mm, respectively with additional radiating fracture lines extending from these wounds. There were small cortical defects around the edges which can be regarded as "outward beveling" of a gunshot wound and two small notches diagonally located at each margin of wound (Fig. 2). These characteristics might indicate that these two wounds were inflicted with a same instrument. Although these defects re-

Fig. 2. Notched defects in the frontal bone of "No. 16-1" individual. Arrows indicate that two V-shaped notches are located catercorner on the marign of defecat.

semble the penetrating (without a exit wound) gunshot wounds at a glance, they must not have been gunshot wounds because the margins of these defects were not smooth circular but irregular with two V-shaped notches for each, and outward beveling around each hole that are ordinary observed around exit wound (Quatrehomme and Iscan, 1997). Both wounds could be made with a same kind of instrument of a pointer with two edges on the basis of its size and shape. Judging from the size and shape of the wounds, the artillery was considered to be a narrow, double-edged sharp instrument.

2) Cut marks

3 cut marks could be recognized in this individual (No. 3, No. 5, and No. 12 in Table 1). The cut mark in occipital bone was thought to be a fail attack for decapitation as Morimoto and Hirata (1992) reported (Fig. 3). There was a thin and narrow cut mark (No. 5, Fig. 4) on superior articular surface of the 7th cervical vertebra.

Another cut mark could be recognized in the right scapula (Fig. 5). The exercised power for this wound is considered to be insufficient to cut off this bone.

3) Cut-off marks

All the remaining 24 marks were identified as cut-off marks. These wounds could be classified

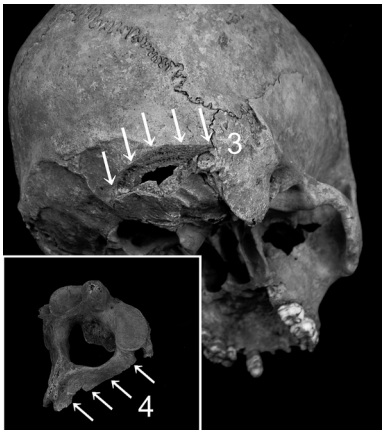

Fig. 3. Cut marks in the occipital bone and cut-off mark in axis. Arrows indicate sharp force wounds. Numbers on this figure correspond to ones in Table 1.

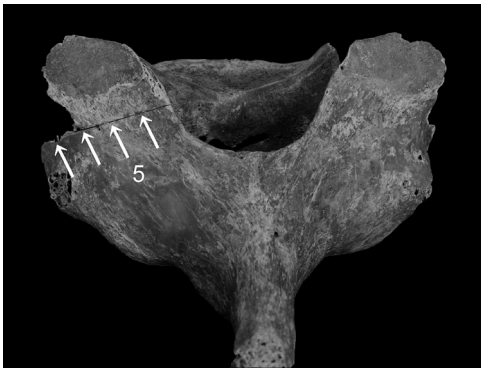

Fig. 4. Linear cut mark on the 7th cervical vertebra.

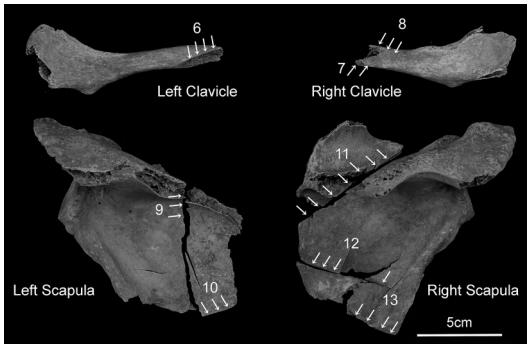

Fig. 5. Sharp force wounds in clavicles and scapulae. Arrows indicate sharp force wounds. Numbers on this figure correspond to ones in Table 1.

into three sub-categories on the basis of directions. A) The horizontal cut-off marks could be recognized all over the trunk bones. B) The vertical cut-off marks were concentrated on the upper part of the trunk. C) The oblique cut-off marks were recognized at some ribs. It is likely that a horizontal cut-off mark on the axis have made during decapitation of this individual (No. 3, Fig. 3).

Judging from the positions and directions of the wounds, the multiple attacks were aimed around the shoulder. Two cut-off marks in right clavicle and one in left clavicle were made in horizontal and oblique direction (Fig. 5). In scapulae, there are three directions of cut-off marks as vertical at base of spine of left scapula (No. 9, Fig. 5), oblique from superior-lateral to inferior-medial direction at base of spine of right scapula (No. 11, Fig. 5), and horizontal at inferior part of right and left scapulae (No. 10, No. 12, and No. 13, Fig. 5). Moreover, there were vertical cut-off marks on the 1st, 2nd, and 4th ribs (Fig. 6). It is likely that three vertical attacks on clavicle, upper part of scapula, and these ribs have been performed. Judging from theses positions, it is plausible to infer that the vertical wounds observed in the left clavicle, the left scapula, and the left ribs were inflicted simultaneously by single vertical attack. Horizontal attacks on the lower part of scapulae seem to show some similarity to those delivered on vertebrae and ribs described below.

Surprisingly, there were at least seven horizontal attacks on his trunk as follows; 1) above 6th thoracic vertebra, 2) under 6th thoracic vertebra, 3) above 10th thoracic vertebra, 4) under 12th thoracic vertebra, 5) above 2nd lumbar vertebra, 6) under 3rd lumbar vertebra and above 4th lumbar vertebra, 7) under 5th lumbar vertebra and upper part of right hip bone (Fig. 7–9). Oblique wounds on 8th and 11th ribs were not regarded for counting this number because the level of sectioned level of these ribs could change easily according to the shape of thoracic cage. Oblique and parallel cut-off marks on each rib also indicate twice horizontal sectioning force on the rib as showing in Fig. 10.

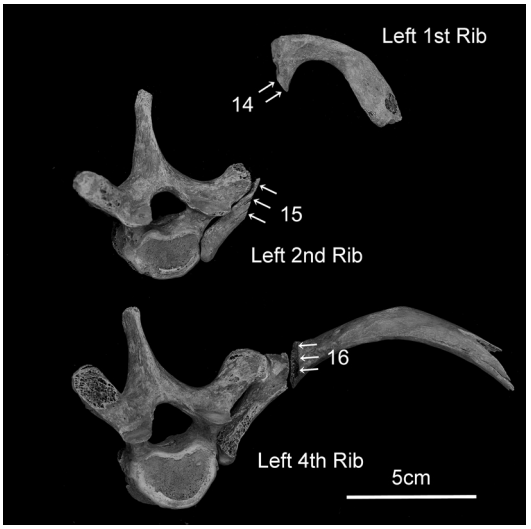

Fig. 6. Vertical cut-off marks in upper part of thoracic cage. Arrows indicate sharp force wounds. Numbers on this figure correspond to ones in Table 1.

"No. 16-2"

This individual was restricted to the 7th thoracic vertebra, right and left 7th ribs, the 1st lumbar vertebra, the 2nd lumbar vertebra, and the 4th lumbar vertebra (Fig. 11). The annual epiphyses rings in all vertebrae of this individual and epiphyseal heads of ribs were still unfused. These facts indicated that the estimated age at death of this individual was around 15–18 years old (Scheuer and Black, 2000).

The sharp force wounds of this individual were listed in Table1. There were two cut-off marks on the upper and lower facets of the 7th thoracic vertebra body (Fig. 12). Each right and left 7th rib had two oblique and parallel cut-off marks. There were one cut-off mark on the upper part of the 1st lumbar, and two on the upper and lower parts of the 4th Lumbar vertebra. Therefore, there were at least five horizontal attacks on his (or her) trunk as recognized in this individual.

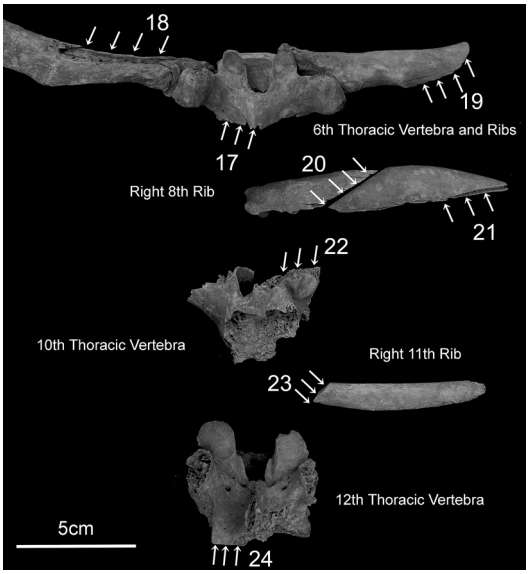

Fig. 7. Horizontal and Oblique Cut-off marks in thoracic cage. Arrows indicate sharp force wounds. Numbers on this figure correspond to ones in Table 1.

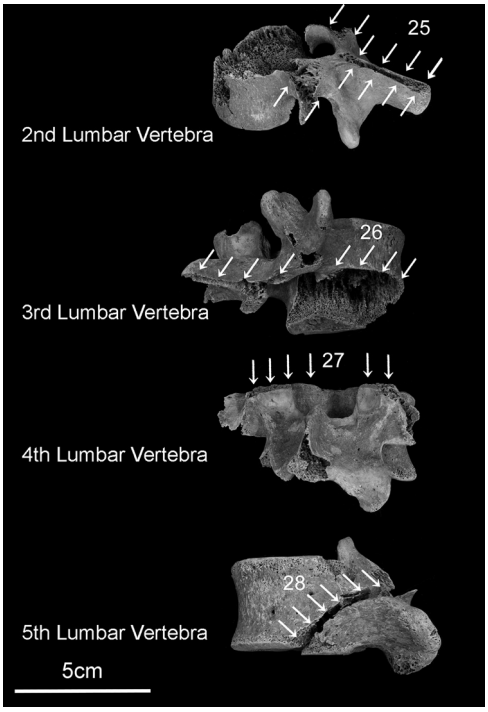

Fig. 8. Horizontal and Oblique Cut-off marks in lumbar vertebrae. Arrows indicate sharp force wounds. Numbers on this figure correspond to ones in Table 1.

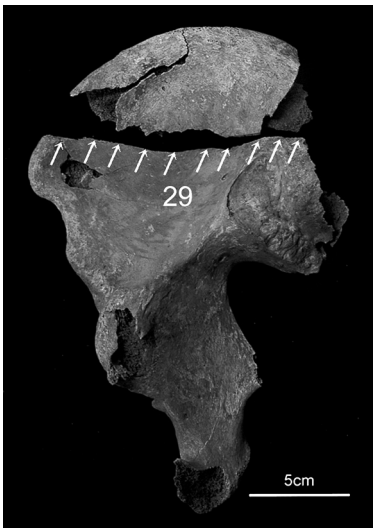

Fig. 9. Horizontal Cut-off marks in hipbone. Arrows indicate sharp force wounds. Numbers on this figure correspond to ones in Table 1.

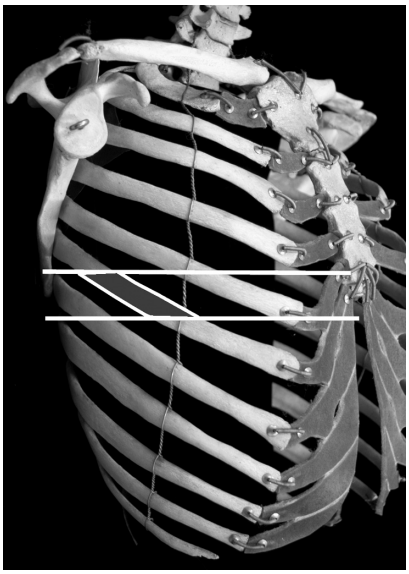

Fig. 10. Oblique and parallel cut-off marks in the right 8th rib and the horizontal sectioned thoracic cage. Lines mean the imaginary horizontal sectioned line in the thoracic cage and its colored area of rib is consistence with the shape of cut-off marks of “No. 16”.

Fig. 11. Preservation of “No.16-2” individual.

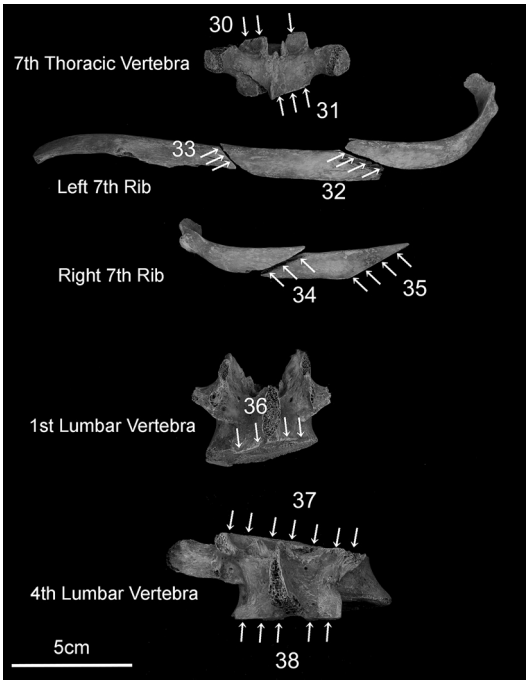

Fig. 12. Cut-off marks in the vertebrae of “No. 16-1”. Arrows indicate the cut-off marks. Numbers on this figure correspond to ones in Table 1.

“Unidentified rib fragments”

There were fourteen fragments of ribs which cannot be identified the number and individual. Six fragments of ribs had two oblique and parallel cut-off marks and eight fragments had one oblique cut-off marks.

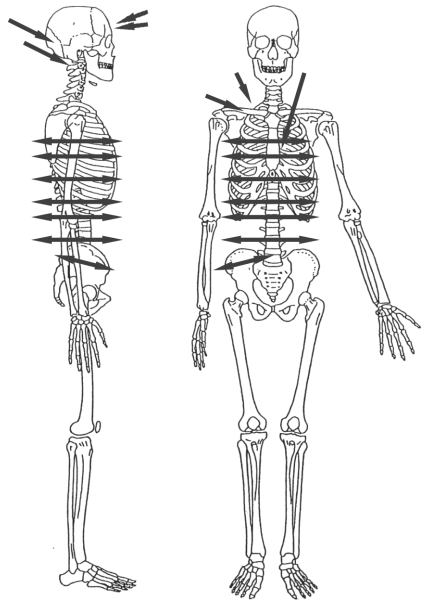

Fig. 13. Reconstruction of the directions and frequency of sharp force wounds in the anatomical position of “No. 16-1”.

Discussion

As above mentioned, at least 57 sharp force wounds were observed in “No. 16” of the Yushima 4-chome burial. Figure 13 shows the estimated direction of the attacks that inflicted the wounds observed in “No. 16-1”. He was attacked twice at his neck and decapitated at his axis, and two notched defects on his frontal. His trunk was also attacked vertically on each shoulder and horizontally sectioned at least seven times. It is important to note that there has been no wound among long bones in spite of it preservation. The defense injuries have often found in limb bones in order to defense oneself under attack (Schmidt and Pollak, 2006). This fact indicates that many injuries were inflicted on “No. 16-1” after making him irresistible for repetitive attacks. The two attacks on his neck could be the first and fatal considering that the decapitation was done for execution. After decapitation, his corpus must have been suffered from several attacks.

Moreover, all the wounds except for the notched defects on his frontal and cut mark on

7th cervical vertebra were performed with a keen weapon enough not to stop during sectioning his trunk. This weapon must have been a Japanese sword (*katana*) because this weapon have always been used for decapitation during the Edo period, only the Japanese sword and the Japanese gisarm had broad, sharp, and heavy enough for sectioning whole breadth of man's trunk at once.

During the Edo period, there was the mutilation of a corpus intentionally for the punishment after decapitation as a part of legitimate criminal justice procedure. This is "tameshi-giri" procedure. A word of "tameshi-giri" means to test the cutting ability of a Japanese sword literally. This was related to a kind of execution to make an example of a convicted felon and was also performed in order to evaluate the quality of swords (Ujiie, 1999). The Tokugawa Shogunate executed criminals in various ways; Decapitation with Japanese sword (this category could be divided into "*Geshunin*", "*Shizai*", and "*Gokumon*" in response to a committed crime), Crucifixion, Burning, and Sawing for death penalty (Okubo, 2008). Among these punishments, "tameshi-giri" was performed as a part of "*Shizai*" execution which was imposed basically on male felons not belonging to Samurai or clergy class. "Tameshi-giri" as a part of extra criminal execution survived till the beginning of Meiji period. The warrants for sharpness of a Japanese sword were carved as "saidanmei" on the tang of the blade. "Saidanmei" consists of the name of the tester, the cutting position of corpus, and the number of corpuses that could be cut off simultaneously (Fig. 14). For "tameshi-giri" procedure, a decapitated corpse was securely placed on an elevated soil ("dotanba") and held its limbs in the extension position by somebody to test a quality of a sword (Fig. 15) (Hachiya, 1814). A performer of "tameshi-giri" stood by a corpus and cut at the fixed point. Sometime, several corpses (2 to 7) were piled on a soil in order to confirm how many bodies could be cut off with a Japanese sword.

Figure 16 shows an illustration for cutting position of corpus in the textbook "Kaihou Ken-

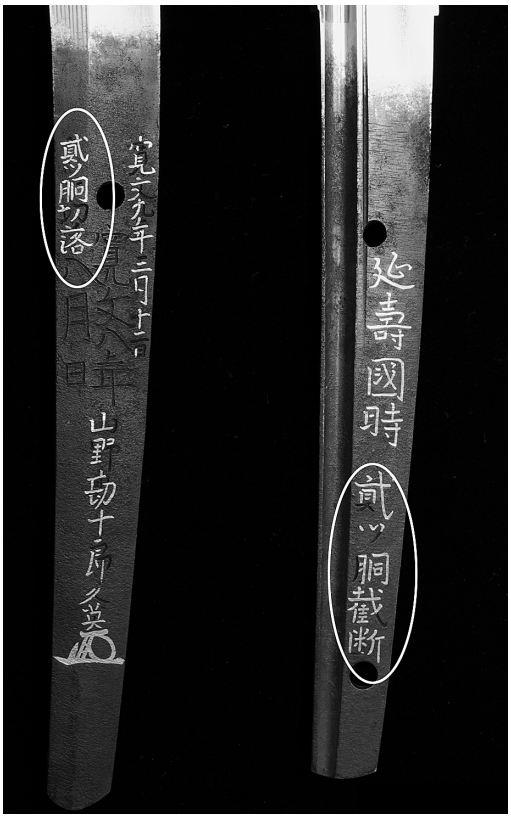

Fig. 14. Examples of "saidamnei" carved on the tang of the Japanese sword. The Chinese characters "貳ツ胴切落" aound line in both sword means that two corpus were completely cut off simultaneously with this sword.

jyaku" for appraising a Japanese sword supervised by Yamada Asauemon Yoshimutu who was one of member of the famous Yamada lineage as authority of the executor and performer of "tameshi-giri" (Sudo and Yamada, 1797). This picture corresponds well with the position of cut-off marks in "No. 16-1" individual (Fig. 8) even in vertical direction of cut-off marks around the shoulder. This correspondence strongly suggested that "No. 16-1" individual has been utilized for "tameshi-giri" after his decapitation.

Two notched wounds on the frontal bone were considered to be inflicted with a narrow, double-edged sharp instrument that is quite different from a Japanese sword. According to Yamada (1830), the test of the ability of a Japanese spear

Fig. 15. Illustrated preparation for “tameshi-giri” This illustration were excerpted from Hachiya (1814)

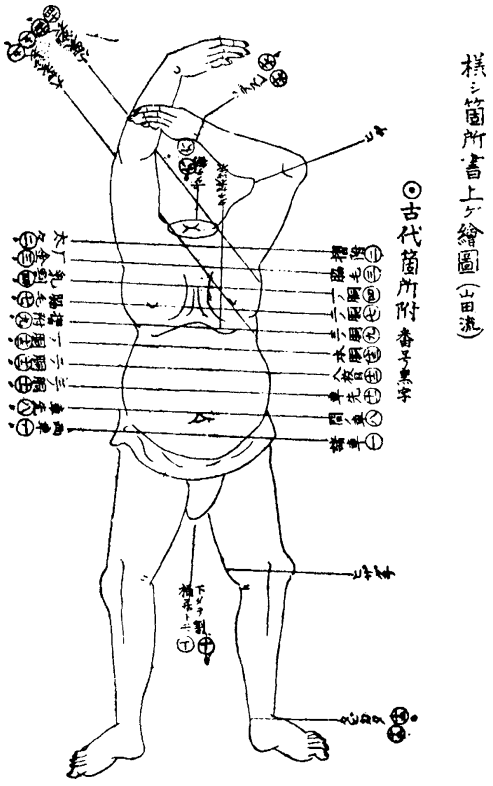

Fig. 16. Illustrated positions for “tameshi-giri” in Yamada style. This illustration were excerpted from Sudo and Yamada (1797).

was performed by using the head of the “Tameshi-giri” victim. Two notched defects on the frontal bone of “No. 16-1” might be made under this procedure.

The same horizontal cut-off marks in the “No. 16-2” as in the “No.16-1” mean that two young men have been sectioned at their trunks with the same way. Their corpses were probably underwent “tameshi-giri” at a same time, as piling their bodies for two or more bodies cutting.

In regulation of the Edo era, a corpus after “tameshi-giri” was left at the execution ground (Okubo, 2008). The question is why this individual has been buried at the cemetery with a contamination of a part of “young individual”. In historical records, the Yamada family who monopolized “tameshi-giri” business from the early 18th century also engaged in the making of medicine called “Jintan” by utilizing the kidney of the corpses after “tameshi-giri” and selling at their house officially (Ujiie, 1999). This fact suggests that a corps could be taken by the Yamada family to their house after “tameshi-giri”. Ujiie (1999) estimated that the families of a criminal could receive the criminal’s corpus in secret at the Yamada house. This is reason why the “No.16-1” individual could be buried at the cemetery and a part of “young individual” might be mixed at the time.

The reason why the cut mark on the 7th cervical vertebra and the cut-off mark on the 5th cervical vertebra were made remains to be unclear. These wounds may be occurred at the time of setting its corpus on an elevated soil or extracting its kidney.

This is the first report of the skeletal injuries inflicted by “Tameshi-giri”. Aside from ethical problems, this awful custom seems to show the complete seriousness of the Samurai warriors on the performance of the edged weapons.

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