

Ritualistic cranial surgery in the Qijia Culture (2300-1500 BC), Gansu, China

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Abstract: Evidence of cranial surgery, in the form of trepanations, has been found at prehistoric archaeological sites from all over the world. Within this large body of evidence, it is clear that trepanations vary in size, location and the reason for which they were performed. Numerous trepanations have been discovered at archaeological sites across China, but very few have come from Qijia Culture (2300-1500 BC) sites in Northwest China. This research describes a well-healed trepanation on an adult male individual(M179:R2) from the Mogou site and compares it to contemporaneous examples from China that date from 3000-0 BC in order to elucidate how and why this procedure was performed. A small circular opening with slightly irregular, but well-healed, margins was identified on the left parietal bone, immediately posterior to the coronal suture. The characteristics of the lesion suggest that the scraping method was employed to create the opening. Unfortunately, the advanced stage of healing made the identification of the specific instrument used in the trepanation impossible. The characteristics of the incision and the archaeological context led the authors to propose that the trepanation on M179:R2 was performed as part of a magico-ritual, rather than for a non-ritual medical purpose. This is supported by the presence of multiple individuals, mainly men, from the Mogou site with similar well-healed trepanations.

Keywords: Trepanation; Surgery; Northwest China; Mogou; Bronze Age

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1. Introduction

Evidence of early cranial surgery, in the form of trepanations, has been found at prehistoric archaeological sites from all over the world^[1-5]. A trepanation is a procedure that involves the removal of a portion of the skull. In prehistoric populations, trepanations were conducted both pre- and post-mortem by using a variety of techniques such as scraping, incising, sawing or drilling through the cranial bone with a tool made out of wood, stone, bone or metal^[6,7]. The trepanations that have been identified in archaeological assemblages vary drastically in size, shape and their location on the skull. Similarly, the motives for performing this procedure vary across cultures and include medical treatment, or as part of a magico-therapeutic or magico-ritual^[8-9]. Trepanations performed for magico-therapeutic purposes are performed to relieve symptoms, such as headaches or seizures, that were perceived to be caused by a supernatural phenomenon such as an evil spirit possessing the body, while those performed as part of a magico-ritual were not conducted to relieve symptoms but solely as part of a ritual^[8].

Approximately 30 trepanations from 15 archaeological sites in China ranging from 3000~0 BC have been published^[3,7,10]. Within China, many of the archaeological examples of trepanations are described as being small, circular holes that are most commonly located on the right or left parietal bone or occipital bone^[1,7]. However, large and irregular-shaped trepanations, where a large section of the cranial vault was removed, have also been identified^[7].

The vast majority of the published examples of trepanations in China come from Northwest China, specifically the Xinjiang Uyghur Autonomous Region, but very little is known about how and why trepanations were performed in other regions of China. The aim of this research is to describe an example of a well-healed trepanation identified on an individual from the Qijia Culture (2300~1500 BC) and compare it to contemporaneous examples in order to elucidate how and why this procedure was performed during the Bronze Age in Northwest China.

2. Materials & methods

An opening was identified on the skull of an adult individual (M179:R2) that was excavated from the Mogou site, Lintan County, Gansu, China (Fig.1). Radiocarbon dates conducted on human material from this site suggest that Mogou was inhabited from 1750~1100 BC, with the main occupation dating to the Qijia Culture (1750~c.1500 BC) and a smaller number of graves that date to the Siwa culture (c.1500~1100 BC)^[11]. The burial of individual M179:R2 inside a chambered tomb with multiple individuals, as well as the burial's location in the cemetery, suggest that he belonged to the Qijia Culture.

The Qijia Culture spanned the transitional period from the terminal Neolithic to the Early

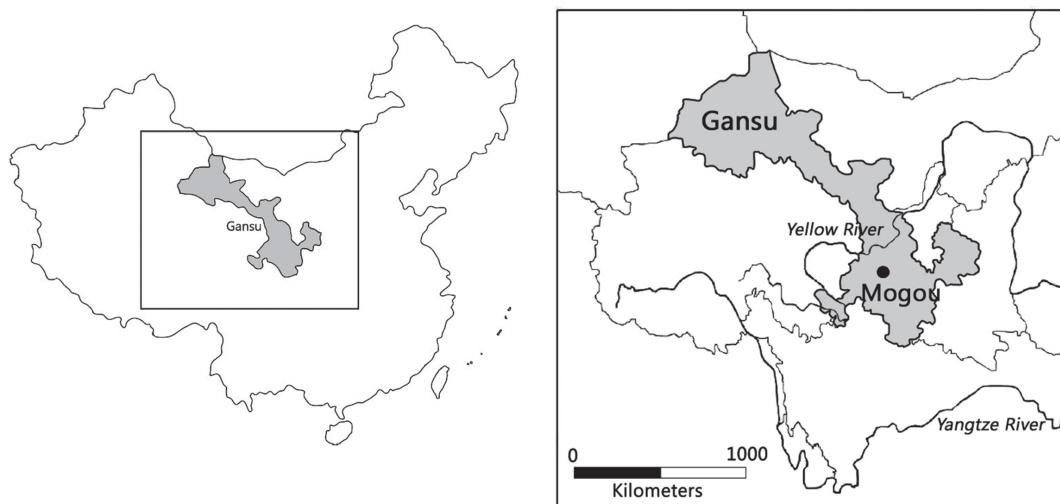


Fig.1 Map showing the modern borders of Gansu Province and the location of the Mogou site, Lintan County, Gansu

Bronze Age in Northwest China^[12,13]. The Qijia material culture complex is found across a wide region of the northwest Loess Plateau, the eastern Hexi Corridor, and the eastern Qinghai Plateau, and was widespread throughout the upper Yellow River Valley and its tributaries^[12-14]. The Qijia Culture facilitated cultural contact and the exchange of material culture and technology between the regions that bordered it, including the central Asian agropastoral and Chinese agricultural spheres^[15,16]. Bronze metallurgy, for instance, spread from Central Asia into the Yellow River region via Northwest China, meaning that Mogou and other Qijia sites were part of an important cultural bridge^[15].

The skeleton of individual M179:R2, currently housed at the Gansu Provincial Institute of Cultural Relics and Archaeology, was visually assessed. The biological sex of this individual was estimated by assessing the morphological characteristics of the os coxae^[17-19]. The morphology of the pubic symphysis and auricular surface were used to estimate the individual's age-at-death^[20-22].

A differential diagnosis was conducted in order to ascertain the causative mechanism of the observed cranial opening. The diagnostic criteria outlined by Verano^[23] were consulted to determine that the opening identified on M179:R2 was a trepanation. The characteristics of the surgical opening in the skull were assessed macroscopically with the aid of a hand lens(x10). The findings were then compared to published examples of trepanations from the Northwest region of China that pre-date 0 BC.

3. Description of lesion & differential diagnosis

The skeleton of individual M179:R2 was well preserved, approximately 80% complete and

that of a mature adult male (45-59 years old). A complete palaeopathological assessment was conducted and revealed that this individual suffered from osteoarthritis in the cervical spine. Both healing and active striated periosteal new bone was present on both tibiae but no evidence of violent trauma or of any specific infectious disease was identified.

The skull was intact and well preserved, with some minor taphonomic damage and root etching present on the cortical bone of the cranial elements. A small, approximately circular opening with slightly irregular margins was identified on the left parietal bone. The opening in the cranial vault measured 4.45mm antero-posteriorly and 4.73mm laterally (Fig.2a). There was a slightly raised ring of bone surrounding the opening. This circular ‘raised halo’ was located 2.19mm posterior to the coronal suture and extended 26.11mm along the sagittal plane and 26.77mm along the coronal plane. The raised ring extended across the sagittal suture on to the right parietal bone for approximately 3mm - 5mm(Fig.2b). From the surrounding halo, the bone tapers toward the centre of the opening. Although thin, the rounded margins of the opening and loss of the diploic structure was observed, which indicates that the incision was well healed at the time of death.

The characteristics of the opening are inconsistent with ossification defects, such as partial or complete dysostosis and with meningocele^[23]. Nor is the observed opening likely the result of a traumatic sharp-force injury. The opening has tapered margins that could not have been created by a superficial strike with a sword or knife. Equally unlikely is a diagnosis of a healed depressed fracture or healed blunt-force trauma as there is no evidence of concentric or radiating fractures.



Fig.2 a) Superior view of the skull of M179:R2 showing the location of the trepanation; b) Close up of trepanation from the superior view showing the location and extent of scraping

The extent of healing further rules out penetrating trauma as survival from a penetrating injury to the cranial vault is unlikely. The thin, tapered edges of the opening that are surrounded by a slightly raised circular halo of bone are consistent with a scrapped trepanation. The extent of the healing suggests that this procedure was performed a substantial amount of time, possibly several years, before this individual's death. In research conducted on clinical populations, it has been shown that there are significant differences in the morphology of the margins of a trepanation after various periods of time^[24]. Trepanations do not show osseous healing until approximately 70 days after the procedure and the opening is often never completely obliterated, even when the trepanned fragments are replaced^[24].

4. Discussion: Trepanations throughout Northwest China

4.1. Trepanning techniques

One of the most common techniques used to perform an ante-mortem trepanation during the Bronze Age in Northwest China was the scraping method^[7]. When this method was employed, force was applied horizontally to a tool to incise the cranial bone until it was eventually penetrated. The tapered edges of the surgical opening observed on M179:R2 confirm that this technique was used to create the trepanation observed. As seen on individual M179:R2, trepanations created using the scraping method in China are generally circular in shape and the tool was moved inwardly towards the center(the area of the intended opening) from the outer circumference. The 'halo' surrounding the surgical opening indicates the extent and location of where scraping occurred(refer to Fig.2).

Due to the advanced stage of healing, it was not possible to determine the specific tool used to perform this procedure. It is generally reported that the instruments used to perform prehistoric trepanations are made out of wood, stone, bone or metal; a tool made out of any of these materials could have been used to create the opening on the cranial vault of M179:R2^[6,7].

4.2. Motive for performance

Today, trepanations are a routinely performed surgical procedure that are used to relieve acquired intracranial pressure after severe cranial trauma, in cases of intracranial neoplasms, and in cases of cerebral and meningeal neoplasms^[24]. However, several alternative reasons have been put forth to explain this diverse and wide-spread practice in the ancient world. The three most commonly suggested motives for the performance of a trepanation during prehistoric eras are: medical treatment, magico-therapeutic ritual, and magico-ritual^[3,8, 9,25].

The use of trepanation as a medical treatment for cranial trauma has been identified in Western China during the Iron Age(2170±30 BP)^[3]. However, as no evidence of trauma was

found on M179:R2, this trepanation was likely not performed for that reason, nor were there any pathological changes on the skeletal remains that would provide further insight. It is not possible to entirely rule out a medical condition as the reason for this trepanation, as it could have been performed as a response to any number of conditions, including increased intracranial pressure not caused by trauma. As many conditions do not cause osseous changes, it is not possible to determine if this procedure was intended to be therapeutic.

Trepanations performed as part of a ritual, either magico-therapeutic or magico-ritual, have been found in Northwest China. Some trepanations from this region were performed post-mortem, and several distinctive differences have been identified between ritualistic trepanations and those conducted for non-ritual therapeutic purposes. Individuals with post-mortem trepanations, such as those from No.IV Cemetery, Chawuhu, Hejing, Xinjiang Province, an early Iron Age(1000-500 BC) site, often had multiple openings in the cranial vault that varied in shape and size. Some individuals from this site had as many as seven openings of different shapes, none of which had any evidence of healing^[7].

Although there are a few cases of individuals that had two trepanations that were performed ante-mortem, it is highly unlikely that numerous trepanations located across the skull would have been employed as a therapeutic measure^[7]. Further examination of the trepanations from Chawuhu revealed that the method used to perform post-mortem trepanations differed from those performed ante-mortem. Post-mortem trepanations from this region were created using the grooving method, rather than by scraping or drilling through the cranial bone. As a result, the openings on many of the individuals from Chawuhu were square-shaped, rather than circular or oval, as the majority of the ante-mortem trepanations found in Northwest China are.

Many prehistoric trepanations are identified as ritual, because it is very difficult to identify a medical reason for an ante-mortem trepanation with only skeletal evidence. The advanced stage of healing and the use of the scraping technique on M179:R2 is similar to the conditions of reported therapeutic trepanations elsewhere in Northwest China, and it is not possible to rule out a therapeutic reason for the trepanation. However, the other cases of trepanation identified at Mogou show a pattern of age and sex distribution that strongly suggests a ritual meaning.

4.3. Trepanation at Mogou

In the case of M179:R2, the archaeological context from the Mogou site provides compelling evidence that the observed trepanation was part of a ritual as multiple individuals from Mogou had similar well-healed trepanations^[26]. Of the 432 skulls examined, 2.5% ($n=11$) presented with a single well-healed trepanation. It is also worth noting that not a single unhealed or incomplete trepanation has been identified at the Mogou site. The majority of the trepanations identified, were located on the anterior aspect of the left or right parietal bone and the scraping method was employed to create each trepanation(Fig.3). Consistency in the location of the openings and the use of scraping was found on the skulls of both males and females. No evidence

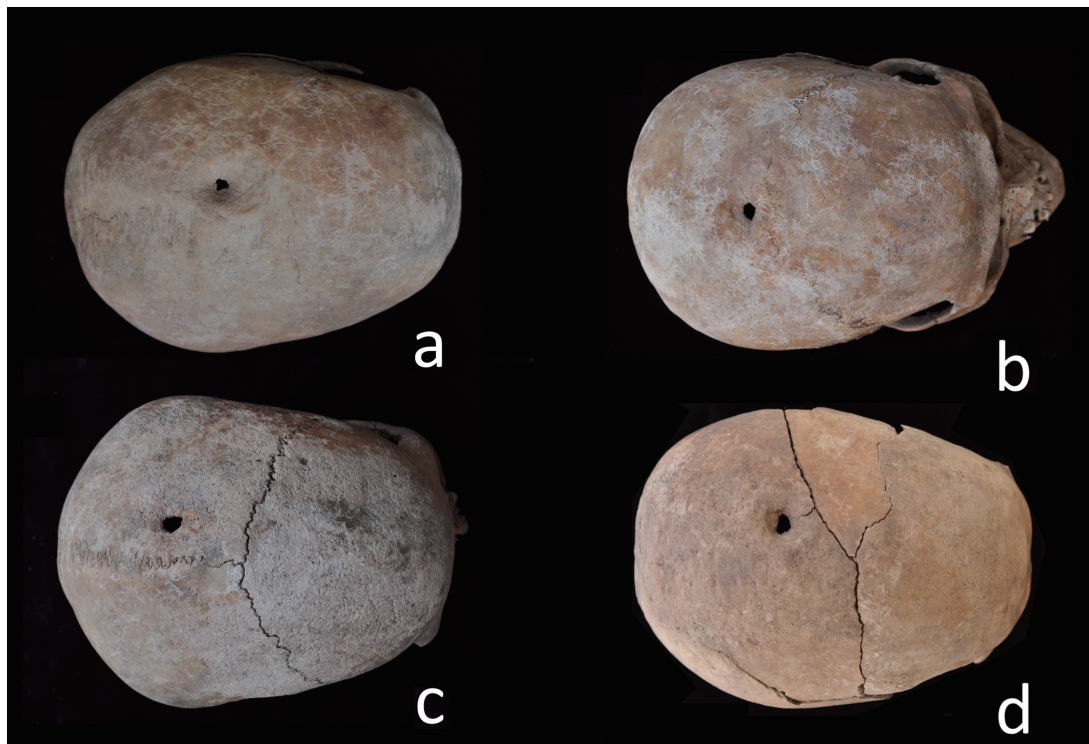


Fig.3 Superior view of skulls with trepanations found at Mogou; a) 1331:R2, b) 662:R2, c) 1381, d) 1247:R2

of other cranial trauma was identified on the skeletal remains of any of these individuals.

Furthermore, ante-mortem trepanations during the Bronze Age in Northwest China were mostly performed on adult males, which suggests a ritualistic motive^[7]. This is reflected at Mogou, where the recipients of trepanations had a sex ratio of 8:3 in favour of males. Due to the small number of trepanations from Qijia Culture sites, the reason for this observed gender disparity is unclear. It could be possible that the male bias seen in the presence of trepanations in Northwest China could be linked with a specific social position that was held predominately by men, yet not exclusively. Further research on trepanations is necessary to fully understand the role that this procedure had within the ritual practices of the Qijia Culture.

5. Conclusion

This example of a well-healed trepanation contributes to our understanding of how and why trepanations were performed during the Bronze Age within the Qijia Culture. The methods employed and the shape of the opening suggested that the trepanation on M179:R2 was performed ante-mortem, but no evidence was found that would suggest a medical motive for its performance. Rather, the presence of multiple individuals with similar well-healed trepanations buried at the Mogou site suggest that the performance of trepanations was likely conducted

as part of a ritual practice. This type of cranial surgery may have been linked to a social position within the Qijia society, however future analysis of mortuary practices and additional examples of trepanations are needed to fully understand the significance of this procedure.

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甘肃齐家文化中仪式性开颅手术初探

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摘要: 作为脑外科手术的一种, 开颅术在世界多地史前遗址中均有发现。大量发现表明开颅术在颅骨上的尺寸、位置及手术原因千差万别。开颅术在中国境内亦有发现; 但在齐家文化(2300-1500BC)遗址中十分少见。位于甘肃省甘南藏族自治州临潭县陈旗乡的磨沟遗址是一处重要的齐家文化墓葬遗址。本文将重点讨论一例磨沟出土的开颅个体, 该成年男性个体(M179:R2)颅骨上有愈合程度较高的开颅术的痕迹; 同时, 将其与其他同时期(3000~0 BC)中国出土的开颅术个体进行比较分析, 从而论证阐述开颅术实行的原因及过程。该个体左侧顶骨冠状缝后侧位置处有一圆形穿孔, 其小孔边缘不甚规则, 且有明显愈合痕迹。穿孔切口的特征显示该穿孔由刮削法完成。但由于该穿孔高度愈合, 我们无法准确判断完成穿孔所使用的工具。该个体上开颅术的特征以及相关考古学资料使得作者们认为 M179:R2 进行开颅术的原因或与巫术仪式有关。同时, 磨沟出土的其他带有开颅术个体(大多数是男性, 且颅骨开颅处愈合程度较高)也支持这一观点。

关键词: 开颅术; 外科手术; 中国西北; 磨沟; 青铜时代

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