# CASE REPORT

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# Probable Torticollis Revealed in Decapitated Skull

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**ABSTRACT:** The skeletal features of a moderately decomposed decapitated head recovered in 1993 are consistent with torticollis (wryneck) and inconsistent with other possible syndromes. Asymmetries of the face, cranial vault, mandible, and cervical vertebrae closely resemble published cases of paleopathological and recent torticollis. The laterally directed left occipital condyle and articulation of the basicranium and cervical vertebrae indicate that the head was tipped toward the left shoulder. Right-left asymmetries of areas of muscular attachments are compatible with a leftward head deviation. Mild arthritis of the atlantal-occipital and intervertebral joints, clinoid bridging, and thickening of the inner table of the frontal squamosa may not be related to the possible torticollis. The postural deviations of the head and neck may aid in the identification of this homicide victim, as did skeletal evidence of torticollis in an earlier case from Britain.

**KEYWORDS:** forensic science, forensic anthropology, physical anthropology, human identification, torticollis, wryneck, skull

## Case Circumstances

On 27 January 1993 two adolescent girls found a human head within a wooded area of a state park in Jefferson County, Illinois. Initial scene investigation revealed that the head might have been thrown into the woods from a nearby access roadway. A subsequent search of the area did not uncover further remains.

Postmortem examination revealed an apparent Caucasian female with fairly long reddish-brown hair. The head was in a state of moderate postmortem decomposition with dehydration of the eyes, scalp slippage and softening of facial skin and other soft tissues. Assuming that the head was disposed of in the park soon after death, an estimation of the postmortem interval until discovery would be between four days and two weeks. The manner of transection of the soft tissues appears to have been that of a single stroke, suggesting a sharp knife was used and that the decapitator was fairly strong and, therefore, probably male. Included with the specimen were the first four cervical vertebrae and a lateral pedicle of the fifth. Examination of the head revealed hemorrhages and lacerations that suggested at least six to seven impacts or blows to the head in life, shortly before death, although there was no evidence of associated skull fracture. The postmortem examination revealed the cause of death to be blunt trauma to the head. The manner of death was presumed to be homicide.

Osteological assessment of the remains was consonant with the autopsy appearance of a white female. The postmortem visual inspection of the face suggested an age span between the late twenties and late thirties. Because of the necessary reliance on cranial suture closure, osteological criteria for age assessment proved to be frustratingly imprecise, but suggested an approximate range of 30 to 50 (1–4).

## Description

The cranial vault is remarkably thick, particularly in the area of the frontal bone. The outer table, diploe, and inner table all appear thicker and denser than normal. The impressive thickening of the inner table of the frontal squamosa may be the result, at least in part, of hyperostosis frontalis interna, a usually asymptomatic condition found almost exclusively in women, usually middle age or older. However, the cerebral surface of the frontal does not display the classic ropelike or puckered appearance of that condition (5), although there are a few small, hard bony nodules on the cerebral surface, rather like little, irregular ivory osteomas. The thickened cranial vault exhibits none of the morphologic or radiographic features associated with hemolytic or iron deficiency anemia (5,6), or with Paget's disease of bone (5).

There is significant asymmetry of both cranial vault and facial regions. Endocranially (Fig. 1), the middle and anterior cranial fossae are considerably larger on the right side, while the posterior fossa is somewhat larger on the left. The crista galli of the ethmoid deviates to the left, and the superior sagittal sinus deviates to the right. The anterior and posterior clinoid processes of the sphenoid are connected on both sides, although this feature may not be linked to the pathological changes. Facially (Fig. 2), the inferior nasal spine deviates to the right, and the right orbit is larger than the left. There is no evidence of previous facial fractures.

The mandible also presents some asymmetries. The right mandibular condyle is somewhat more developed that the left. The digastric groove is more distinct on the left than on the right, as is the prominence of the chin, especially around the origin of lower lip depressor muscle. The somewhat greater development of the lateral pterygoid plate of the sphenoid on the left side corresponds to the slightly more inferior placement of the mandibular pterygoid insertions on the same side, apparently an adjustment to increased

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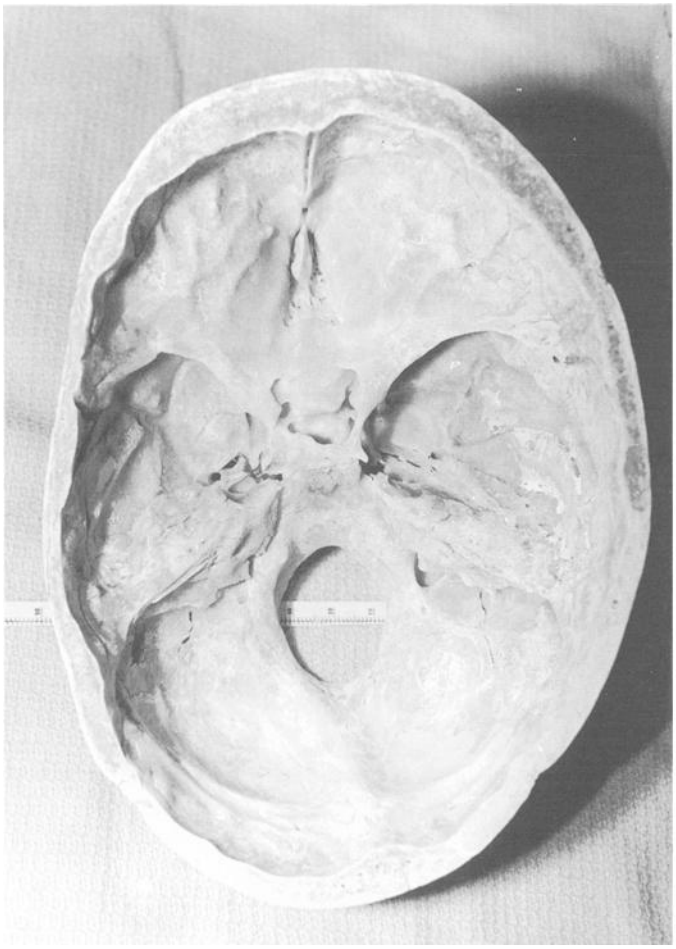

FIG. 1—*Endocranial view of skull base showing asymmetries of the cranial fossae and ethmoid.*

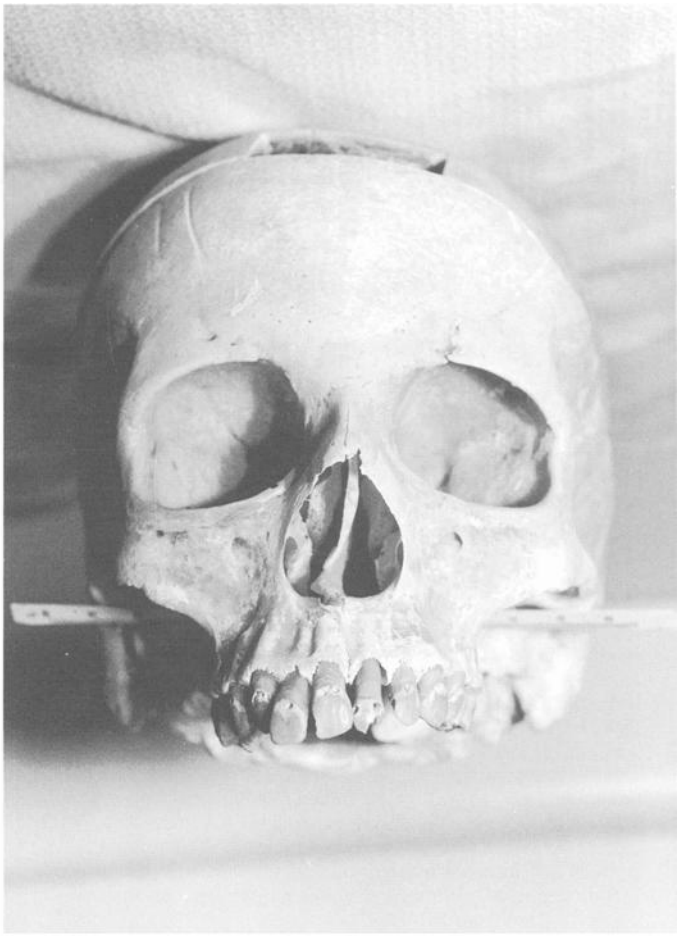

FIG. 2—*Facial view of skull showing skeletal asymmetry.*

muscular mechanical advantage. Thus, the morphology of the mandible indicates chronically uneven stress during mastication, with greater stress on the left side.

Asymmetries are also evident on the base of the skull (Fig. 3). The right mastoid process is 3 mm longer than the left. The insertion point of rectus capitis lateralis shows greater prominence on the right side, and the insertion for rectus capitis posterior major is also somewhat more pronounced on the right side. The left occipital condyle is directed more laterally than the right. The basilar asymmetries include the first and second cervical vertebrae where the transverse processes are more prominent on the right than the left side. This is especially noticeable on the atlas and probably again reflects the greater stress on the right rectus capitis lateralis and rectus capitis posterior major, which have their origin on the transverse process of C1.

## Discussion

These cranial abnormalities closely resemble paleopathological cases attributed to torticollis, or wryneck, from Hawaii (7), Canada (8,9), and Europe (10). The present specimen also resembles a description published by Smith in 1939 (11) of a skull recovered in Britain and later identified as belonging to a woman who suffered from wryneck. Distinctive features of other possible anomalies, such as cervical vertebral fusion and/or other cervical vertebral anomalies in Kleippel-Feil syndrome, and hypoplastic mandible and zygomatic arches of Goldenhar syndrome (12) are not present in this specimen and make such diagnoses less likely than spasmodic torticollis. Although hemiplegia or other partial paralysis involving muscles of the face and head cannot be ruled out, the skeletal sites of tendon attachments exhibit asymmetric hyperdevelopment rather than asymmetric wasting, as could be expected in long-standing partial paralysis.

Although spasm of one sternocleidomastoid muscle, rotating the face and chin in one direction and tipping one ear toward the shoulder on the side of the spasm, would seem the obvious antecedent of the unilaterally enlarged mastoid process, the mechanism may not be so straightforward. Two previously mentioned publications on the effects of torticollis on the skull come to conflicting conclusions about the relationship between mastoid length and head tilt. Douglas (7) favors the interpretation that the constant sternocleidomastoid muscular tension enlarges the mastoid process and tethers the head to the ipsilateral side. Thus a relatively elongated right mastoid process would indicate that the head was tilted toward the right shoulder. For the Hawaiian skulls, Douglas (7) reported that there is a positive association between indentation of the occipital condyle and length and robusticity of the mastoid on the same side, but does not detail the strength or exact nature of this association. The hypothesized cause and effect relationship between sternocleidomastoid tension tipping the ear to the shoulder and mastoid process enlargement on the same side seems intuitively correct. If this is indeed the correct mechanism for the generation of asymmetries, them it should hold in all

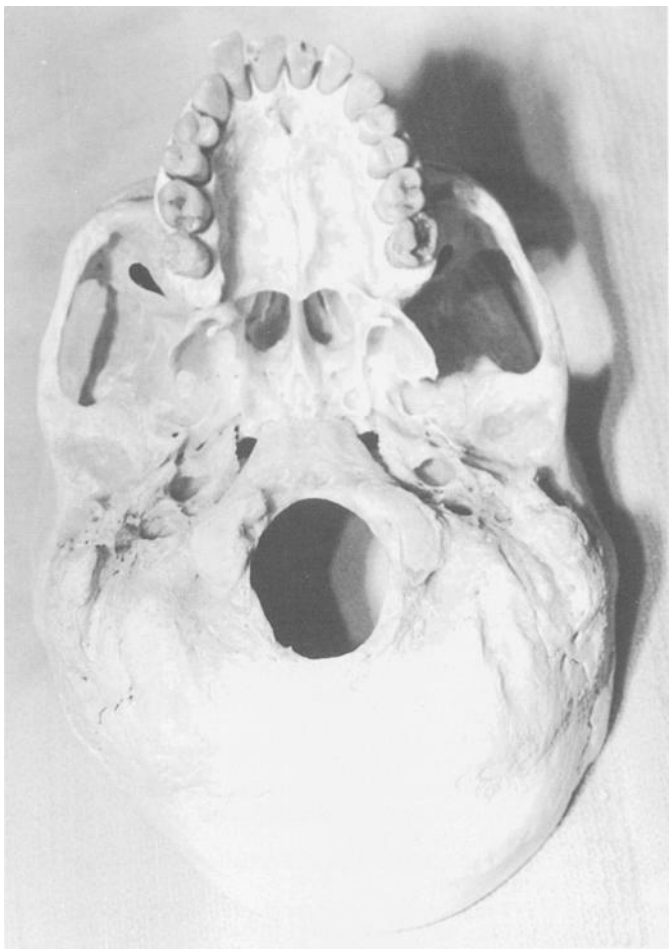

FIG. 3—*Basilar view of skull showing asymmetrical muscle attachments and the orientation and arthritis of the condyles.*

cases. But there is evidence that it does not. In the case involving the British skull, Smith (11) reported an enlarged right mastoid process with the left occipital condyle directed more laterally and concluded that the head was tilted toward the left shoulder. The present specimen also presents this combination of traits, and articulation of the cervical vertebrae to the skull also distinctly indicates a leftward tilt of the head. In this case it would appear that the hypertrophic development of the right sternocleidomastoid and rectus capitis lateralis and rectus capitis posterior major insertions reflects a more or less constant effort to restore an upright head posture. A leftward tilt also might account for the greater chewing stress on the left side. Thus it would appear that directionality of the occipital condyles is a better guide to direction of head tilt than length of the mastoid process. Moreover, this case presents the cautionary lesson that functional anatomy interpretations from skeletal markers may be more complicated than would at first appear, at least in some instances.

The asymmetries in the area of the chin around the origin of the lip depressor muscles might reflect the slight pursing of the lips and minor twitches of the mentalis muscle that may accompany idiopathic spasmodic torticollis (13). The well-developed origins of trapezius on both sides fits with the frequent bilateral involvement of these muscles (13).

Although chronic torticollis seems the most likely diagnosis for this case, these skeletal remains present no clearcut indication of whether the conditional was of congenital, pediatric or adult onset, although the condition usually begins in early to middle adult life and gradually worsens (14). Some cases of spasmodic torticollis show spontaneous remission, and others may spread beyond the neck, most commonly to the muscles of the face and jaw (15). It is not necessary to assume an early onset is required to produce skeletal alterations. Although clinical studies directed at skeletal involvement are sparse, cranial and/or facial asymmetries have been reported in 10 to 20% of cases of adult onset idiopathic spasmodic torticollis (13).

Another uncertainty in this case is whether the unusual thickness and density of the cranium in the area of the frontal squamosa is etiologically associated with the torticollis. Abnormal cranial thickness was not mentioned in the earlier reports. However, most of those appear to involve intact skulls, and therefore any excessive vault thickness could well go unnoticed. In this case, the autopsy cut clearly revealed the condition. As stated earlier, the frontal thickness may be a variant of hyperostosis frontalis interna, or be the result of another unrelated cause. If it is causally associated with the torticollis, the physiological mechanism is not obvious.

A final question involving the pathological features of this skull centers on a 2.1 cm linear lesion on the upper left parietal (Fig. 4) that may represent the largely healed remnant of previous trauma to the outer table of the cranial vault. The report of similar cranial lesions in two of three skulls exhibiting features of torticollis from the prehistoric Northwest Coast (9) invites speculation as to whether there might be a meaningful association between previous head trauma and cranial anomalies resulting from or mimicking torticollis. Another example involves the case of an unknown,

FIG. 4—*Superior view of skull showing a 2.1 cm linear lesion on the left parietal 0.3 cm lateral to the sagittal suture and 5 cm posterior to the coronal suture.*

male, Florida homicide victim reported as possibly having congenital muscular torticollis (16). The ultimate identification of the individual nullified the diagnosis of torticollis, but revealed a history of head trauma [Wienker, written communication, 1995]. A few cases of torticollis following head trauma have appeared in the clinical literature, and there is a suspicion that such associations may be under-reported (17).

One would think the physical features of torticollis would be well-known to acquaintances and serve as a major clue to recognition and identity. Besides the postural deviations of the neck and head, torticollis is often painful and prompts the sufferer to seek medical attention. Although the symptoms of spasmodic torticollis may be quite varied, they characteristically involve intermittent, arrhythmic contraction spasms of not only the sternocleidomastoid, trapezius and other neck muscles, but also muscles of the face, jaw, and tongue (14). Torticollic movement may be deliberately smooth or jerky, and sometimes deviation of the head may be accompanied by an irregular tremor, perhaps resulting from an effort to overcome contraction of the neck muscles (14). Spasms may be worse when the patient is upright and lessen or cease when the patient lies down (11,14). Antecedent scoliosis, facial asymmetry, and thyroid disorder have been reported as common in patients with torticollis, especially females (13). The recognition of torticollis in the British skull quickly led to its identification as that of a missing local woman suffering from wryneck. In the present case, neither the identification of the victim nor her medical history has yet been finally resolved.

## Summary

Unusual skeletal characteristics of the skull and upper four cervical vertebrae from an unidentified severed head suggest that the victim suffered from chronic spasmodic torticollis, or from a condition that mimics the head deviation and skull asymmetries of torticollis. Functional anatomical analysis of the atlantal-occipital articulation and of the asymmetries of skeletal sites of muscle attachments indicate that there was greater stress on the muscles responsible for maintaining upright head posture on the side contralateral to the direction of head tilt. Evidence of a healed traumatic lesion on the skull suggests that the condition may have been preceded by head trauma; similar associations have been reported in both osteological and clinical literature.

The postural leftward deviation of the head is a potential trigger for recognition among acquaintances. A medical history that likely includes orthopedic and/or neurological consultation also may provide a clue to identity.

## References

(1) Mann RW, Jantz RL, Bass WM, Willey PS. Maxillary suture obliteration: a visual method for estimating skeletal age. J Forensic Sci 1991;36:781–91.
(2) Meindl RS, Lovejoy CO. Ectocranial suture closure: a revised method of determination of skeletal age at death based on the lateral-anterior sutures. Am J Phys Anthropol 1985;68:47–56.
(3) Acsadi GY, Nemeskeri J. History of human life span and mortality. Budapest: Akademai Kiado, 1970.
(4) Key CA, Aiello LC, Molleson T. Cranial suture closure and its implications for age estimation. Int J Osteoarchaeol 1994;4: 193–207.
(5) Ortner DJ, Putschar WGJ. Identification of pathological conditions in human skeletal remains. Washington, DC: Smithsonian Institution Press, 1985.
(6) Steinbock RT. Paleopathological diagnosis and interpretation. Springfield: Charles C Thomas, 1976.
(7) Douglas MT. Wryneck in ancient Hawaiians. Am J Phys Anthropol 1991;84:261–71.
(8) Kidd KE. A note on the paleopathology of Ontario. Am J Phys Anthropol 1954;12:610–15.
(9) Skinner M, Barkley J, Carlson RL. Cranial asymmetry and muscular torticollis in prehistoric northwest coast natives from British Columbia (Canada). J Paleopathology 1989;3:19–34.
(10) Smrcka V, Gomolcak P, Simicek V, Salas M. Skull asymmetry in prehistoric human skeletal remains: A comparative study documented with clinical cases. Anthropologie (Brno) 1986;24:7–21.
(11) Smith S. Studies in identification, No. 3. The Police Journal, London 1939;12:274–85.
(12) Goldman RM, Gorlin RJ. Atlas of the face in genetic disorders. St. Louis: C. V. Mosby, 1977.
(13) Duane DD. Spasmodic torticollis. In: Jankovic J, Tolosa E, editors. Advances in neurology, Facial dyskinesias. New York: Raven Press, 1988;49:135–50.
(14) Adams RD, Victor M. Principles of neurology. 4th ed. New York: McGraw-Hill, 1989.
(15) Greene P, Kang UJ, Fahn S. Spread of symptoms in idiopathic torsion dystonia. Mov Disord 1995;10:143–52.
(16) Wienker CW, Wood JE. Congenital muscular torticollis? in an unidentified adult homicide victim. Presented at the 43rd Annual Meeting of the American Academy of Forensic Sciences; 1991 Feb 18–23; Anaheim, CA.
(17) Krauss JK, Mohadjer M, Braus DF, Wakhloo AK, et al. Dystonia following head trauma: a report of nine patients and review of the literature. Mov Disord 1992;7:263–72.

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