Cranial Percussion

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Key Words

Percussion • Skull • Auscultatory percussion • Macewen's 'crack-pot sound'

Abstract

Percussion of the skull dates from a time when there were virtually no radiological methods for examining the skull and brain. Three apparently independent contributions appeared within the years 1893–1895. The sound elicited, tenderness, and auscultatory percussion have each been employed for diagnostic purposes, but have long been superseded.

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Percussion of the skull is now long outdated, but its history is of interest, dating from a time when there were virtually no radiological methods for examining the skull and brain. Three apparently independent contributions (Bruns, Oppenheim, Macewen) appeared within the years 1893–1895. Percussion of the skull elicited sound or tenderness; auscultatory percussion was another technique employed for diagnosis.

Cranial percussion was attributed by the modest Oppenheim to the German neurologist, Ludwig Bruns (1858–1916) who in 1895 stated:

'Considerable value is to be placed on the presence of a dull note over a suspected brain tumour as a means of differentiation between cortical and subcortical growths, a dull note favouring a cortical localization.' [1]

Hermann Oppenheim (1858–1919), the leading German Neurologist of his generation, noted this change especially in tumours adjacent to the bone or dura. In his classic textbook [2] of 1894, he says:

'Percussion of the skull likewise often reveals much in focal diseases of the brain and its membranes. Auscultation should not be forgotten ...' [p. 18]

In the chapter on brain tumours, we read:

'Percussion over the cranial region where the tumour lies may produce a tympanitic or crackpot sound (Bruns). It may occur under other conditions also, and is always present in sucklings.' [p. 576]

Oppenheim here refers to Bruns, yet Oppenheim's German 1st edition of 1894 just predates Bruns's contribution of 1895. We can only guess that Bruns may have presented a paper or published elsewhere before 1894.

Beerman [3] cites Koplik as saying:

'Percussion of the skull at an early period of tuberculous meningitis is certainly one of the most valuable aids in diagnosis.'

Unfortunately, the citation includes neither date nor reference.

Sir William Macewen in 1893 (who, in 1879 operated on a brain tumour before Rickman Godlee's 'landmark operation' of 1884 [4]) applied skull percussion to aid diagnosis of suspected tumours or abscesses of the brain. On percussion of the skull behind the junction of the frontal, temporal, and parietal bones, in hydrocephalus,

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there was a more resonant [tympanitic] note than normal. In cerebral abscess, he suspected the mass was compressing veins thus causing hydrocephalus, which caused a characteristic 'crack pot sound', [5] sometimes known as Macewen's sign.

Beerman read a paper before the San Francisco County Medical Society, September 1, 1914: 'The clinical value of percussion of the skull' in detecting hydrocephalus caused by purulent (meningococcal) meningitis:

'Lumbar puncture showed the diplococcus of Weichselbaum. In both cases, percussion elicited a tympanitic note over the right pterion, which was in marked contrast with the normal note over the left. The presence of this tympanitic note was assumed to indicate a purulent distension of the right lateral ventricle. At autopsy the right lateral ventricle in both cases was found distended with pus; the left were normal. By no other means at our command could this associated lesion be diagnosed.' [3]

He also mentioned:

'A case of hydrocephalus associated with a tumor of the fourth ventricle recently seen through the courtesy of Dr. Newmark gave on percussion a cracked-pot note over the whole of the skull. At autopsy both lateral ventricles were immensely distended. And, a patient with hydrocephalus, secondary to syphilitic basal meningitis, was of interest in that the gradual change of note from marked tympany to normal could be followed as the patient progressed to recovery.'

In other cases, he elicited a tympanitic note or a cracked-pot sound, especially where a separation of the sutures has occurred within the cranial vault. An alteration of note would guide the surgeon to the localization of the lesion.

But before than any of these papers, Sir David Ferrier MD, FRS, experimental neurophysiologist and neurologist in 1879, advocated the use of skull percussion in localizing brain lesions. He had found that a tap on the head over the responsible lesion often aggravated symptomatic headache:

'A patient under my care staggers when walking and ... when the feet are placed together ... falls backwards ... there is complete deafness in the left ear, partial paralysis of motion and anaesthesia of the left side of the face and loss occipital region, with nausea and feeling of sick-ness ... percussion over the left superior curved line of the occiput causes very marked intensification of the headache ... the symptoms and the situation of the pain are thus mutually confirmatory of lesion, probably tumour, in the left cerebellar lobe.' [6]

Although he had no post-mortem confirmation in the 11 instances he cited, he concluded that percussion of the

skull was a valuable adjunct to diagnosis: 'with a view to testing its value over a much wider range of clinical and pathological observation than can possibly occur to any one individual'.

Percussion was used often if not routinely for many years [7] utilising both the altered sound elicited and also localised bony tenderness, until more sophisticated techniques of ventriculography, angiography, and more recently CT and MRI superseded this bedside test.

Auscultatory Percussion

Auscultatory percussion was much earlier first described by D.M. Cammann and Clark in the *New York Journal of Medicine and Surgery* (July 1840) [8]. It found application in the skull. Direct percussion was applied lightly with the pulp of a finger in the midline of the forehead above the frontal sinuses. The stethoscope was applied alternately from one side to the opposite side of the head at corresponding anatomical areas [10]. Thomas and Hamilton from Johns Hopkins in 1897 described a patient with a left hemisphere 'neuroglioma' [9] in whom:

'Dr. Camac discovered by auscultatory percussion that there was an area on the left side of the mid-parietal region in which the note was of a lower pitch than that over the rest of the head. It was also noted that while the veins over the left temporal region were very prominent, those over the right were not to be seen.'

'... This sign was present in two cases of tumor of the frontal lobe which were operated on for me. In the first case it was pointed out by Dr. Allen Starr [*J Nerv Mental Dis*, Oct., 1896, p. 660], and in the second case, in which it was very evident, the frontal bone, at the time of the operation, was found to have been reduced to the thinness of paper.'

But, they noted the technique was prone to error:

'In a third case I believed the sign to be present, but at the autopsy no tumor or other condition was found to explain it. From my own experience ... it is easy to be deceived, and upon which reliance should be placed only when the difference in the percussion note is well marked and constant.'

Surprisingly, attempts were made to resuscitate auscultatory percussion, when in 1982 despite the advent of computed tomography and magnetic resonance images Guarino [10] described 89 consecutive patients with suspected intracranial lesions examined by auscultatory percussion in a blind study. Eighty-nine consecutive patients with suspected intracranial masses were examined. Each underwent computed tomography (CT). Fifty-one

had abnormal CT scans, of whom 44 (86%) had positive findings on auscultatory percussion; 7 (13%) yielded false-negative results. Of 27 patients with normal CT scan 25 had normal findings on auscultatory percussion, 2 (7%) gave false-positive results. The underlying principle is that sound waves are reflected and refracted by a

medium of different density and physical character lying within an otherwise uniform material. The transmission of sound is impaired to the degree of the impedance mismatch between the different media.

This historically interesting physical sign has been superseded.

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