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"Tap Sign" in Tuberculoid and Borderline Tuberculoid Leprosy[1]

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ABSTRACT

Deep pain upon percussion of lesions over bone in tuberculoid leprosy, in spite of superficial sensory impairment, has been described as the "Tap Sign" (TS). This study was conducted to identify possible causes for this phenomenon and to determine the sensitivity and specificity of this sign in leprosy patients with lesions overlying bone. In 37/53 patients with lesions over bone, the sensitivity of the TS was 66.7% and the specificity was 100%. The positive predictive value was 100%, and the negative predictive value was 75%. The Tap Sign appears to be a useful clinical sign in diagnosis of tuberculoid and borderline tuberculoid leprosy where a lesion overlies a bone (sensitivity 66.7%). This test could be very useful to increase the clinical diagnostic yield, in the global perspective, in places where leprosy is diagnosed and treated by healthcare workers and primary care physicians without other laboratory facilities. Possible mechanisms responsible for the deep pain are discussed.

RÉSUMÉ

La douleur aiguë profonde après percussion de lésions de lèpre tuberculoïde localisées au-dessus de surfaces osseuses, malgré une perte sensorielle superficielle, a été décrite comme le signe de percussion (Tap sign ou TS), proche du signe de Tinel. Cette étude a été menée afin d'identifier les causes possibles de ce phénomène et pour déterminer la sensibilité et la spécificité de ce signe clinique chez les patients lépreux présentant des lésions recouvrant des aires osseuses. Parmi 37/53 patients avec lésions recouvrant un os, la sensibilité du TS était de 66,7% et la spécificité de 100%. La valeur prédictive positive était de 100% et la valeur prédictive négative de 75%. Le signe de percussion apparaît être un signe clinique utile pour diagnostiquer les formes de lèpre tuberculoïde et tuberculoïde borderline lorsqu'une lésion est localisée au dessus d'un os (sensibilité de 66,7%). Ce test pourrait être utile pour augmenter l'efficacité du diagnostic clinique, dans une perspective globale, notamment aux endroits où la lèpre est diagnostiquée et traitée par un personnel de santé et des médecins généralistes n'ayant pas d'accès facile aux examens de laboratoire. Les mécanismes possibles responsables de cette douleur profonde sont également discutés dans cet article.

RESUMEN

El dolor profundo durante la percusión de las lesiones de hueso en la lepra tuberculoide, no obstante la anestesia superficial, se describe como signo Tap (ST). Este estudio se realizó con el fin de identificar las posibles causas de este fenómeno y para determinar la sensibilidad y la especificidad de este signo en los pacientes con lesiones dérmicas sobre el hueso. En 37/53 pacientes con este tipo de lesiones, la sensibilidad del ST fue de 66.7% y la especificidad de 100%. El valor predictivo positivo fue del 100% y el valor predictivo negativo del 75%. El ST parece ser un signo clínico útil en el diagnóstico de la lepra tuberculoide y tuberculoide subpolar cuando los pacientes tienen lesiones sobre el hueso (sensibilidad del 66.7%). En la perspectiva global, la prueba puede ser muy útil para mejorar el resultado del diagnóstico clínico en lugares donde la lepra se descubre y se trata por trabajadores de la salud y por médicos de primer nivel que no cuentan con un laboratorio de diagnóstico. Se discuten los posibles mecanismos responsables del dolor profundo.

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Most researchers classify leprosy into 5 main types: polar lepromatous (LL), borderline lepromatous (BL), borderline (BB), borderline tuberculoid (BT), and polar tuberculoid (TT) ([9]). Many patients with tuberculoid (TT) and borderline tuberculoid (BT) leprosy (with semianaesthetic lesions) over bony prominences give a history of "deep pain" when the relevant area is accidentally knocked on a hard object, such as a table top or a chair. A similar sensation can be elicited on tapping the affected area overlying bone, with a paper weight or even with the knuckles of the examining clinician. This paradoxical phenomenon (deep pain, in spite of superficial sensory impairment) was described by the principal author as the "Tap Sign" (Kumarasinghe, 2001) ([7]). "Tap Sign" (TS) is not usually elicited in polar lepromatous leprosy (LL).

MATERIALS AND METHODS

We conducted a study, at the Dermatology Clinic, Base Hospital Panadura, Sri Lanka, to study possible causes for the TS (Part 1) and to determine the sensitivity and specificity of TS in leprosy patients with lesions overlying bone (Part 2).

In the first part of the study**,** 11 consecutive patients with TT and BT with a positive TS were recruited. Skin biopsy, fasting blood sugar, blood urea, white cell, count and ESR were done. The sites on which TS was elicited were x-rayed.

In Part 2 of the study (carried out after Part 1 was completed, on additional patients) 53 new leprosy patients were analyzed. Where a lesion of leprosy was visible over a bone (e.g., elbow, radial border), TS was assessed. Figure 1 shows the technique of eliciting the TS with a paperweight (approximate weight 100 gm). The patients' perception of intensity of pain sensation was compared with the corresponding site on the contralateral side of the same patient. They were requested to say whether pain sensation upon tapping was greater, less, or the same. TS was considered to be positive when the deep pain sensation was greater over the lesional area.

RESULTS

In Part 1 of the study, haematological and biochemical investigations of all patients were normal. The x-rays did not show any periosteal sclerosis, cysts, changes of osteomyelitis, or any other abnormalities. The diagnosis of leprosy was confirmed histopathologically. Histopathology of the TS positive patients did not show any major differences when compared with other biopsies from areas not overlying bone.

In Part 2, the mean age was 34.05 yrs (range 8 to 76 yrs). There were 32 females and 21 males. Of all the leprosy cases, 37/53 (69.8%) had lesions over bone. When all leprosy types were considered 21/37 (56.7%) had a positive TS. Of TT and BT leprosy patients with a lesion over bone, 18/27 (66.7%) had a positive TS on affected side. 14/18 (77.8%) of this cohort were TT and 4/18 (22.2%) were BT. Among multibacillary (MB) leprosy patients (BL, subpolar LL and LL), with lesions over bone, TS was positive only in 3 of 10 (30%) patients. These patients were either BL or subpolar LL patients. None of the polar LL ("pure" lepromatous) patients (N = 5) had a positive TS, although they had lesions overlying bone. In the 2 pure neuritic leprosy patients without skin lesions, TS was negative.

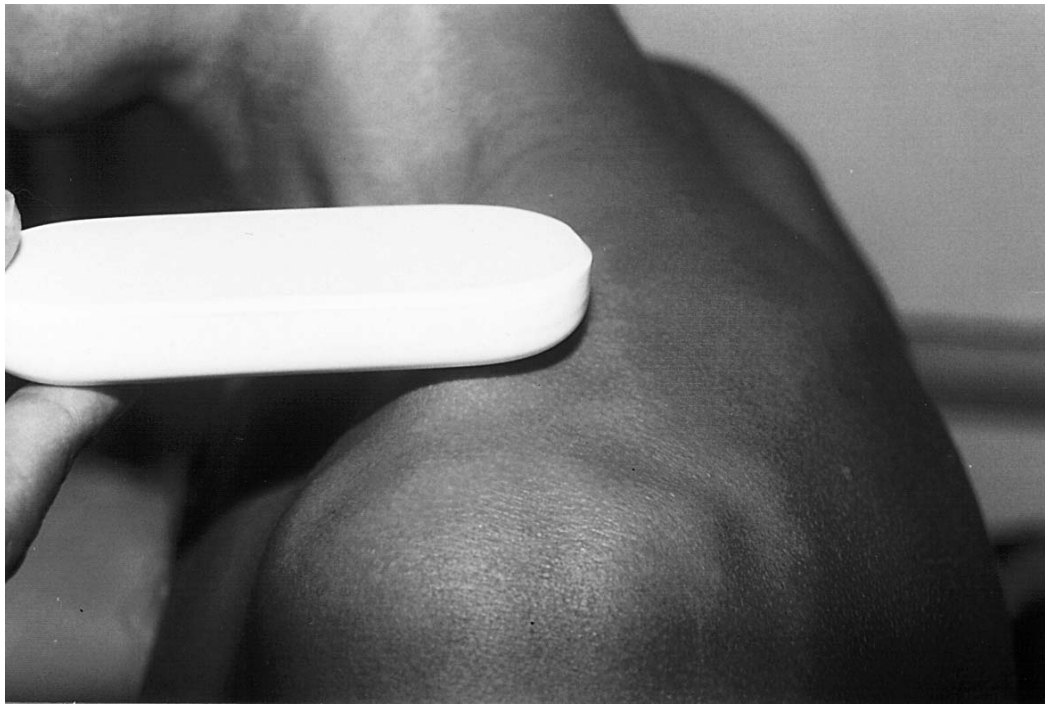
Table 1 shows TS positive and negative groups statistically tabulated. Table 2 shows the measure of association and 95% confidence intervals. The sensitivity of the TS in this study was 66.7% and the specificity was 100% (for lesions overlying bone). The positive predictive value was 100%, and the negative predictive value was 75%.

The size of the skin lesion did not correlate with demonstration of TS or its intensity, as long as the lesion was of sufficient size to test for the TS, e.g., >3 cm. The majority of the patients with a positive TS had had the lesions for less than one year (13/21, 61.9%).

The common sites where TS was demonstrated included: olecranon of the elbow, ulnar border, radial border, patella, tibia, proximal digits, and metacarpals (dorsally) and metatarsals (dorsally).

DISCUSSION

Leprosy is still a major public health issue in many parts of the world ([3, 6, 10, 11, 12]). The incidence of leprosy in Sri Lanka has been below 1/10,000 since 1995, and has been declining in the recent past ([6]). Leprosy is diagnosed and treated in field clinics



THE FIGURE. The technique of eliciting the tap sign with the paper weight: hypopigmented lesion of tuberculoid leprosy, over the left shoulder with a positive tap sign over the acromion.

in many developing countries, by physicians as well as by trained field workers ([11, 12]). Facilities for skin biopsy and microbiological investigations are not available in remote areas. Additional clues to diagnosis of leprosy are useful, in the global perspective ([3]). Wrong diagnosis of leprosy may unnecessarily stigmatize the patient and erroneous treatment with multiple drugs may even cause serious side effects, e.g., haemolytic anaemia or agranulocytosis due to dapsone.

The pain elicited by TS is not a radiating pain, but a dull aching "bony" pain which lasts several seconds. This deep pain sensation is different to the neuralgic pain along the distribution of a sensory nerve trunk or "electric current like pain" when a nerve is accidentally knocked (e.g., ulna nerve at the elbow). It is also different from paraesthesia of peripheral neuropathies. Over the area where tap sign is elicited superficial skin sensations are impaired (when tested with cotton wool or nylon bristles) None of the patients recruited in these studies had any reactional states.

In this study, we demonstrated that 66.7% of patients with hypopigmented skin lesions overlying bone had a positive TS, indicating that it is a useful sign to elicit. None of the non-lesional sites tested for comparison showed any positive TS. This indicates that contralateral non-lesional bony prominences are suitable sites for direct comparison.

TABLE 1. *Comparison of tap sign positive cases, in patients with lesions over bone, with corresponding contralateral sites.*

	Hypopig. lesion over bone	Contralateral site (non lesional)	Total tested sites (lesional & non-lesional)
Tap sign positive	18	0	18
Tap sign negative	9	27	36
	27	27	54

TABLE 2. *Measure of Association and 95% Confidence Intervals for Tap Sign in tuberculoid and borderline tuberculoid leprosy cases with lesions over bone.*

Sensitivity of tap sign	66.7% (95% CI 46.0–82.8)
Specificity of tap sign	100% (95% CI 84.5–100)
Positive Predictive Value	100% (95% CI 78.1–100)
Negative Predictive Value	75% (95% CI 57.5–87.3)

In a subsequent patient, TS was positive over a semianaesthetic area overlying bone, even without any visible evidence of hypopigmentation. The diagnosis in this case was confirmed by biopsy. This suggests that TS can antedate visible cutaneous disease.

We recommend that suspected leprosy patients should be specifically asked for a history of, "deep pain lasting for several seconds when a hypopigmented macule overlying bone is knocked against a hard object." If there is a positive response by the patient, the suspicion of leprosy should be higher, and this could be tested objectively by eliciting TS.

There are several theories to explain the phenomenon of TS. The authors feel that the first possibility (see below) is the most likely.

(i) Where the sensory input from the overlying skin is diminished or absent, due to cutaneous nerve destruction due to leprosy, the pain sensitive periosteal pain fibers may become "relatively more sensitive" and "perceive" more pain, when knocked or tapped on. Periosteum is a dynamic tissue with a rich sensory nerve supply as well as a sympathetic nerve supply ([1, 4]). It is known that the periosteum of the bones near the skin receives sensory nerve supply from the skin, whereas the periosteum of deep bones receives innervation via the muscle attachments. Where TS was negative in TT or BT lesions overlying bone, it is possible that the sensory periosteal nerves are also destroyed by the leprosy disease process.

TS phenomenon may be similar to the "increased perceived hearing" on the side of air conduction deficit, compared to the side of normal air conduction, when tested with a tuning fork, in a patient with a defect in air conduction in the ear canal (Weber's test). Interestingly, when vibration sense of the bone was tested over the TS positive sites (in some patients), there was no difference on the two sides, indicating that nerve fibers carrying vibration sensation are not affected in these patients.

(ii) Lepra bacilli, being "neurotrophic" and spread via the blood stream, may infect the periosteal nerves as well as the cutaneous nerves, giving a sense of painful paraesthesia to the periosteum. This possibility does not however explain why TS is usually negative in polar LL lesions overlying bone.

(iii) The periosteum of the involved area may be involved (periosteitis) although the x-rays did not show any evidence of bone involvement. LL is known to cause an osteitis, but in TT, most of the bone changes described have been distal to a nerve trunk involvement or due to osteomyelitis ([2, 5, 8]). There was no clinical, radiological, or haematological indications of osteomyelitis in our patients. This possibility also does not explain why TS is not present in polar LL.

(iv) The affected cutaneous nerves, when pressed or crushed against the bone and an external hard object, may show a paraesthetic painful sensation. However, when the hypopigmented semi-anaesthetic lesions in tap sign positive areas were squeezed or lightly pinched with the index finger and the thumb, this sensation could not be elicited, indicating that the pathological explanation lies more in the bone.

TS is a user friendly test which can be used in the field clinics in developing countries. There is no added cost. A wooden paper weight or a similar object, or even clinician's knuckles could be used. Comparison with the patients' corresponding normal location makes assessment simple. This simple technique could be taught to healthcare workers who diagnose and treat leprosy in developing countries.

There are some limitations to TS as well. They include: BT and TT patients without lesions overlying bony prominences, extremely obese patients where bony prominences are difficult to find, and small children, debilitated, senile, or unreliable patients who can not respond to the questions about perceptions of pain.

In conclusion, "Tap Sign" is a useful clinical sign in the diagnosis of tuberculoid and

borderline tuberculoid leprosy where a lesion overlies a bone (sensitivity 66.7%). This test could be very useful to increase the clinical diagnostic yield, in the global perspective, in places where leprosy is diagnosed and treated by healthcare workers and primary care physicians without other laboratory facilities. Relative hyperaesthesia of the periosteum below the semianaesthetic lesions appears to be the cause. More research is needed to determine the exact pathophysiology of the pain sensation elicited by TS.

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