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The Paper Grip Test for Screening on Intrinsic Muscle Paralysis in the Foot of Leprosy Patients[1]

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Foot problems are one of the most common causes of 'dehabilitation' and morbidity in leprosy. Mostly, there is a combination of sensory, motor and autonomic nerve affection resulting in progressive loss of protective sensation, weakness and muscle atrophy ([12]). Approximately 10% to 15% of leprosy patients have impairments and disabilities involving their feet, especially plantar ulceration, drop-feet, claw feet and tarsal disorganization ([23]). Recurrent ulceration, in spite of protective footwear, is the most frequent indication for admission in leprosy hospitals.

Although much attention is given to anesthesia of the foot sole as a cause of foot problems in leprosy and other neuropathies of the foot, less attention is given to paralysis of the intrinsic muscles. However, it is thought that anesthetic feet without intrinsic muscle paralysis are not prone to ulceration ([24]). As paralysis of the intrinsic muscles of the hand leads to claw hands, paralysis of the plantar intrinsic musculature of the foot leads to claw toes ([12]). Intrinsic muscles contribute to the architecture of the longitudinal and transverse arches of the foot, which aid in the distribution of mechanical stresses, especially during walking ([3, 19, 20]). Paralysis will lead to abnormal foot structure and increased peak-loads. Clawing of the toes due to intrinsic muscle paralysis also causes a shift in distal direction of the plantar fat pad below the metatarsophalangeal (MTP) joint, exposing the thinner part of the skin to pressure ([7]). Therefore, additional intrinsic muscle paralysis increases the risk of ulceration in anesthetic feet by a factor of 10 to 12 ([23]). The combination of anesthesia and paralysis is found in 85% of all ulcers; the majority is located in the forefoot, especially in the MTP joint region ([8, 23]). Infectious conditions, like osteomyelitis, septic arthritis and septic tendosynovitis are most common complicating factors causing further deformation ([14]).

In the early stage of intrinsic muscle paralysis, education, self-care and special footwear can help in preventing further deformities ([4, 15, 21, 22]). Moreover, claw toe deformity and its consequences may be prevented and corrected by tendon transfer surgery, employing the long flexor of each digit. This procedure is only possible in flexible claw toe deformities and is preferable to procedures used for fixed claw toe deformities (arthrodesis with or without shortening of the toe) because it provides a partial restoration of function ([13]). Thus, just as with the early detection of sensibility loss, the early detection of intrinsic muscle paralysis has important implications for the prevention of impairment and deformity. In spite of this, there is no reliable manual test that can be used as a screening test for intrinsic muscle strength in leprosy patients, unlike the routine tests that are done for the examination of the extrinsic muscles or the sensibility of the foot.

The lack of a reliable screening test gave rise to the development of the Paper Grip Test (PGT) by W. J. Theuvenet and P. W. Roche from The Anandaban Leprosy Hospital, The Leprosy Mission, Nepal, in 1990. This PGT can be used as a screening test for plantar intrinsic foot muscle paralysis. The PGT resembles the Froment test for detection of intrinsic hand muscle paralysis,

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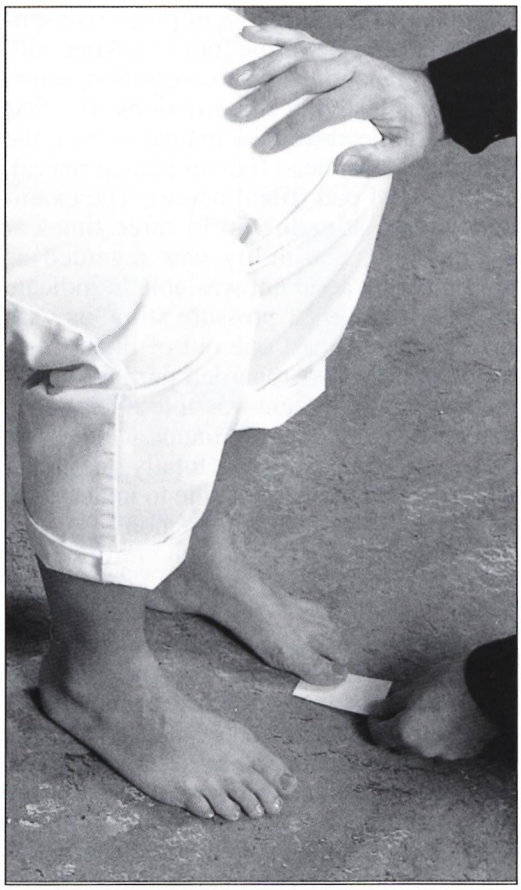

Photograph: The Paper Grip Test of the great toe (PGT1). A paper slip is put under the great toe just distal to the MTP joint. While the examiner tries to pull the paper away, the patient offers maximal resistance. The hand of the examiner rests at patients' knee assuring the heel is kept on the floor.

where the patient has to hold a piece of paper between the pulp of the thumb and that of the index finger while the examiner tries to pull it away ([25]). This test becomes positive when the adductor pollicis, the first dorsal and the second palmar interossei muscles are paralyzed, because the patient, in an effort to hold on to the sheet, will flex the distal phalanx of the thumb before losing grip of the paper. In the PGT for the hallux, the patient will try to hold a piece of paper pressed between the pulp of the big toe and the floor, while the examiner tries to pull it away. If the flexor hallucis brevis is paralyzed, the patient will flex the distal phalanx of the hallux before loosing grip of the paper.

The purpose of this study was to investigate the reliability of the PGT as a screening test for intrinsic muscle weakness of the foot. We investigated the outcome of the PGT in leprosy patients compared to non-leprosy controls. Also, the correlations between the outcome of the PGTs and different factors, such as foot sole sensibility, gender, age and type of leprosy were objectives of this study.

MATERIALS AND METHODS

The Paper Grip Test. Two variants of the PGT were conducted, PGT1 to detect intrinsic muscle weakness of the great toe and PGT2 to detect weakness of the combined intrinsic muscles of the lesser toes (second, third, fourth and fifth toe).

During the test, the person (footwear and socks removed) sits up straight with hips, knees and ankles in 90° of flexion. The examiner insures that the patients stay in the same position and keep their heels on the floor during the test. The patients have to look at their feet, because leprosy patients with anesthetic feet will not feel the paper, causing difficulty in holding the paper.

The examiner puts a slip of strong rough paper under the phalanges of the great toe (for the PGT1) or the four lesser toes (for the PGT2), respectively, just distal to the MTP joints (see photograph). The examiner pulls the paper away with gradually increasing power in a horizontal direction, while the patient offers resistance. In all examinations, solid rough paper (2×10 cm, 100 g/m^2 type) that did not easily tear, and a smooth underground of concrete was used.

The PGT was performed up to three times when the patient was not able to grip the paper. The PGT was considered positive (abnormal) when it was possible to easily pull the strip away all three times. The test was considered negative (normal) when the patient was able to grip the paper at least one out of three times.

Patients and controls. In 1998, during a period of four months, leprosy patients (new patients and patients who came for follow-up) and non-leprosy subjects from the Purulia Leprosy Home and Hospital (The Leprosy Mission, Purulia, West Bengal, India) were examined for their intrinsic muscle function. Patients with paralysis of the long flexors and extensors of the toes,

infective ulceration, rigid claw toes or other gross deformities were excluded. Patients with small non-infected ulcerations were not excluded. The non-leprosy subjects were volunteers without foot deformities, selected from the same background (family members of the patients and persons matched for social standing) in order to prevent bias due to different types of feet and footwear.

Five hundred seventeen leprosy patients and 170 non-leprosy controls met the inclusion criteria. Information about age (<20, 20–39, 40–59 and >59) and type of leprosy (TT = tuberculoid leprosy, BT = borderline tuberculoid leprosy, BB = borderline leprosy, BL = borderline lepromatous leprosy, LL = lepromatous leprosy, PN = pure neuropathic leprosy) was obtained of each person. The proportion of males was 67.4% in the leprosy group and 66.5% in the control group. A majority of males corresponds with the general gender-distribution of leprosy ([11]). The mean age was 30.3 years in a range from 4 years to 81 years old. Of those 517 leprosy patients, 496 met the criteria for both feet and 21 patients met the criteria for only one foot, so a total of 1013 leprosy feet were included in the study. The results of these 21 patients were only regarded in the analysis of the relation between outcome of the PGT and foot sole sensibility. The other analysis required both feet to be included (N = 496).

Extrinsic muscle testing. The functions of the tibialis anterior, the extensor digitorum longus, the extensor hallucis longus, the flexor digitorum longus, and the flexor hallucis longus were tested by means of isometric contraction against resistance in unloaded feet ([6]). For testing of the tibialis anterior, extensor digitorum longus and the extensor hallucis longus, the patient had to move his feet and toes dorsally, while the examiner offered resistance to the extension of the toe and fixed the ankle at 90° of flexion. For testing the flexor digitorum longus and flexor hallucis longus the patient moved his toes plantarwards, while the examiner offered resistance to the distal phalanges and fixed the proximal phalanges in a flexed position to relax the intrinsic muscles.

Sensibility testing. Sensibility of the foot sole was tested by means of a 10 gram Semmes-Weinstein monofilament ([5]). This has been described to be a reproducible method for detecting loss of protective sensation of the sole of the foot ([17]). After adequate explanation and demonstration, sensibility was tested at three regions: the first metatarsal head (medial plantar nerve), the fifth metatarsal head (lateral plantar nerve), and the heel pad (tibial nerve). The examiner gave a stimulus up to three times at each region. Sensibility was regarded as normal when a patient was able to indicate all three regions of pressure stimulus with eyes closed at least one out of three times tested. A foot was regarded partially anesthetic when the patient was able at least once to indicate the pressure stimulus at either one or two an regions and as totally anesthetic when the patient was not able to indicate the pressure at any of the three regions.

Examiners. To diminish information bias, two examiners performed the examination. The first examiner determined whether patients and controls met the inclusion criteria. This examiner also determined the function of the plantar intrinsic muscles of the foot by means of the PGT1 and PGT2. The second examiner, a hospital staff physiotechnician, performed sensibility testing of the sole of the foot as part of a three-month routine check up for leprosy patients. A third examiner was involved to measure the inter-observer variability of the PGT.

Validity and reliability of the Paper Grip Test (PGT). In 7 leprosy patients with loss of protective sensation of the forefoot but normal PGT1 and 7 non-leprosy subjects with normal PGT1, an experiment was done to test the validity of the PGT in determining plantar intrinsic muscle paralysis of the foot. In all 14 persons, the tibial nerve of one foot was artificially blocked by injecting 5 cc bupivacaine 1% inside the tarsal tunnel. After the injection, the PGT1 testing was repeated.

In three healthy persons, we tested the activation of the plantar intrinsic muscles and long muscles of foot and toes, while performing the PGT1 by means of surface electromyography.

Inter- and intra-observer reliability was determined on the basis of the results of the examinations of 20 leprosy patients (N = 40 feet) independently by the first and third examiner, alternately just after each other. Intra-observer variability was determined by examining 43 leprosy patients (N = 86 feet) twice by the same examiner on two

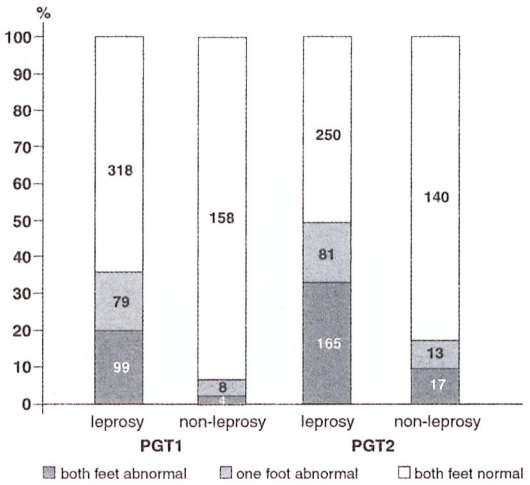

FIG. 1. Positive PGT1 of the great toes and PGT2 of the lesser toes in leprosy patients and non-leprosy controls. Numbers in the columns present absolute numbers of persons.

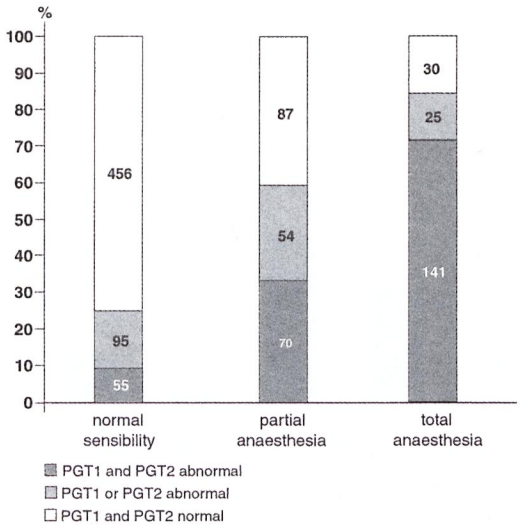

FIG. 2. Positive PGT1 of the great toes and PGT2 of the lesser toes in the feet (n = 1013) of leprosy patients with different levels of foot sole anesthesia; normal sensibility (n = 606), partial anesthesia (n = 211), total anesthesia (n = 196). Numbers in the columns present absolute numbers of feet.

separate occasions with an interval of approximately three months.

Data analysis. The bivariate Pearson correlation-analysis was used to detect linear relations between outcomes of the PGTs and leprosy, foot sole sensibility, gender, age and type of leprosy. Through this analysis it is possible to present the relation between two variables, correcting it for other variables by means of the partial correlation coefficient (pcc). A p-value <0.05 was regarded as significant ([1]).

An agreement in inter- and intra-observer examinations was analyzed separately for PGT1 and PGT2 through the non-weighted Cohen's kappa coefficient (κ-value) for two categories (either PGT positive or PGT negative) ([2]).

RESULTS

PGT in leprosy patients and controls, specificity of the PGT. Figure 1 shows that 35.9% of the leprosy patients (N = 496) had a positive PGT1 and 49.6% had a positive PGT2 of one or both great toes. In comparison, in the control group (N = 170), 7.1% had a positive PGT1 and 17.6% a positive PGT2 of one or both great toes. Corrected for gender and age, significantly more leprosy patients than non-leprosy controls had a positive test (pcc = 0.29 and p <0.01 for both PGT1 and PGT2).

Positive tests in the control group can be regarded as false positive tests, so from these results specificity can be calculated. Sixteen ($2 \times 4 + 8$) false-positive results in 340 tested feet give a specificity of 95.3% for PGT1, and 47 ($2 \times 7 + 13$) false-positive results in 340 tested feet give a specificity of 86.2% for PGT2.

Influence of sensory loss, gender, age and leprosy type on the outcome of the PGT. To examine the relation between a positive PGT and loss of foot sole sensibility, all the feet of leprosy-affected people were regarded separately. These were divided into three groups according to the degree of sensibility loss of the foot sole. Figure 2 shows that 71.3% of the total anesthetic feet had a positive PGT of both great and lesser toes (positive PGT1 and positive PGT2). In the group of partial anesthetic feet 33.2% had a positive PGT1 and a positive PGT2, while 25.6% showed either PGT1- or PGT2-positive. Leprosy feet with a normal sensibility showed a positive PGT1 and/or positive PGT2 in 24.8%. The relation between the degree of sensibility loss and a positive PGT proves to be significant correlated after correction for gender, age and type of leprosy (pcc = 0.49, p <0.01).

The presentation of a positive PGT test among males and females in both leprosy and non-leprosy groups is shown in Figure

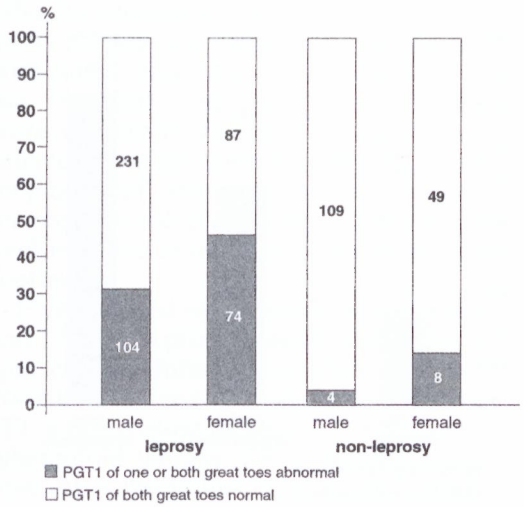

FIG. 3. Positive PGT1 of the great toes in males and females in both leprosy patients (n = 496) and non-leprosy controls (n = 170). Numbers in the columns present absolute numbers of persons.

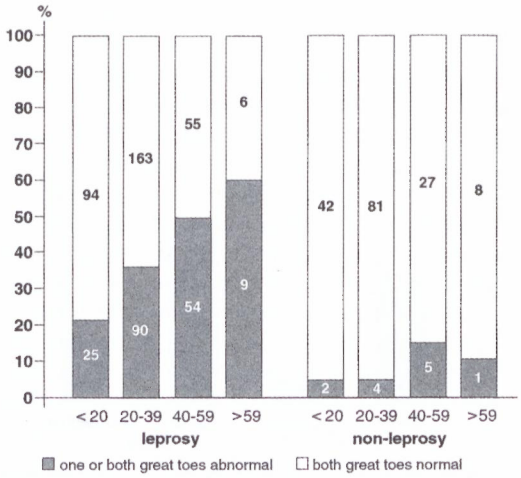

FIG. 4. Positive PGT1 of the great toes in different age groups in leprosy patients and non-leprosy controls. Numbers in the columns present absolute numbers of persons.

3. Female leprosy patients turned out to have a higher prevalence of a positive PGT of one or both great toes (46.0%) than male leprosy patients (31.0%). After correction for age and type of leprosy this relation proved to be significant (pcc = 0.21, p <0.01). In the non-leprosy group these values were 14.0% for females and 3.5% for males (pcc = 0.24, p <0.01).

Figure 4 shows that the prevalence of a positive PGT increases with older age. PGT1 was positive in 49.5% of leprosy patients in the age group 40–59, against 21.0% positive tests in the age group up to 19. After correction for gender and type of leprosy the relation between a positive PGT1 and age proves to be significant for both leprosy group (pcc = 0.22, p <0.01) and control group (pcc = 0.19, p = 0.01).

The distribution of a positive PGT among different types of leprosy is shown in Figure 5. The percentages of patients with positive PGT1 of one or both feet varies significantly per type of leprosy after correction for gender and age (pcc = 0.16, p <0.01). The highest percentages of a positive PGT were found among patients with PN-, BB- and LL-type of leprosy. A positive PGT1 in TT-type of leprosy (14.3%) is two times higher than in non-leprosy patients (7.1%, Fig. 1).

Validity and reliability of the Paper Grip Test. In both leprosy patients and non-leprosy subjects the PGT1 changed from negative (normal) to positive (abnormal) in all 14 feet tested, after blocking the tibial nerve inside the tarsal tunnel with 5 cc bupivacaïne 1%. The long flexors of the foot and toes remained unaffected.

Electromyography in three healthy persons conformed that the plantar intrinsic muscles were used in testing with the PGT. However, also long flexors of the foot and toes showed electromyographic activity.

The κ-value for the inter-observer reliability (non-weighted, 2 categories, N = 40 feet) is calculated at 0.87 [95% CI; 0.69–1.04] for PGT1 and 0.61 [95% CI: 0.34–0.87] for PGT2. The κ-value for the intra-observer reliability (non-weighted, 2 categories, N = 86 feet) is calculated at 0.56 [95% CI; 0.36–0.76] for both PGT1 and 0.56 [95% CI: 0.39–0.74] for PGT2.

DISCUSSION

Validity, specificity and reliability of the PGT. The results of the experiment, before and after the block of the tibial nerve at the level of the tarsal tunnel (not affecting the long flexors and extensors of foot and toes), show that the PGT1 is capable of selectively demonstrating intrinsic foot muscle weakness. The EMG experiment shows that the extrinsic muscles were also activated during the PGT but, by assuring normal strength of the long flexors in all our subjects, there was no difference between our subjects regarding extrinsic muscle function.

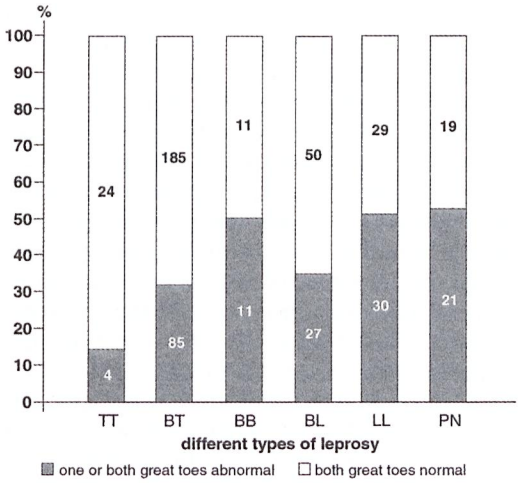

FIG. 5. Positive PGT1 of the great toes in different types of leprosy. Numbers in the columns present absolute numbers of persons.

The specificity of 95.3% for PGT1 found in this study can be considered high as compared to that of other manual muscle strength tests ([16]). There is a lower specificity of PGT2 (86.2%) than PGT1. To prevent many false-positive results the PGT1 is probably a better screening method to detect intrinsic muscle weakness than the PGT2. However, the two tests do not provide identical information, so another possibility, explaining the higher percentages of positive PGT2 as opposed to the PGT1 of the leprosy group, is that the lateral plantar nerve is more often affected by leprosy than the medial plantar nerve.

The inter-observer agreement can be regarded as good for PGT1 and moderate/good for the PGT2. This is comparable to the intertester reliability of other manual muscle strength testing used in leprosy ([9]), but the number of patients was small. The intra-observer reliability is moderate for both PGT1 and PGT2 ([2]). When the moderate κ value really reflects the intra-reliability of the PGT, this is a relative weakness of the PGT. However, the moderate reproducibility may also be caused by actual changes in muscle function during the long interval between the first and second measurement (approximately three months). Especially in the beginning phase of multidrug therapy nerve reactions that cause changes in muscle function may occur.

The correlation that we found between both age and type of leprosy and positive PGTs is similar to the correlation between several disabilities, based on peripheral nerves affection and age and type of leprosy described in other studies ([10, 18]).

The use of the PGT as a screening test for intrinsic muscle paralysis of the foot. The PGT can be a valuable addition to the physical examination of leprosy outpatients. It is a simple, cheap and non-invasive test that does not require additional equipment. These properties make the test especially suitable for screening on the function of plantar intrinsic foot muscles in leprosy patients in hospitals and during fieldwork in developing countries.

From our results we conclude that the screening of leprosy patients with the PGTs in addition to the sensibility testing is very important. First, because we have found that the intrinsic muscles of the great toe are affected in more than one-third of the leprosy patients without gross deformities. Second, because many partially anesthetic feet appeared to have intrinsic muscle weakness. Third, in this study intrinsic muscle weakness of both great and lesser toes is found in more than 70% of the total anesthetic feet, making them especially vulnerable to ulceration. On the other hand, 15% of the patients with total anesthetic feet have strong intrinsic muscles making them less vulnerable to ulceration ([24]). The long-term care of these patients could be limited to regular control of the skin of the foot and the usage of protective footwear. Late development of plantar paralysis, long after cure of the disease, is quite rare. Fourth, because the PGT may give early warning of nerve function impairment in patients with intact foot sole sensibility as measured by the 10 gram monofilament method.

Clinical consequences of a positive PGT—prevention of foot deformity. When impaired intrinsic muscle function of the foot is detected by means of the PGT screening method, this has important clinical consequences. An early sign of the loss of intrinsic muscle function deserves the same treatment as, for instance, signs of ulnar nerve neuritis. Apart from the attempt to treat the neuritis, e.g., with corticosteroids, other measures to prevent deformity of the foot are necessary. When a patient has a positive PGT, a Harris mat print can be used, if available, to detect changes in the

weight bearing areas ([8]) as an indication to adapt the footwear. For example, special protection especially of the metatarsal area can be created by the provision of a rigid sole, which will prevent stress to the metatarsal pads during the push-off phase of walking. In a flat terrain a rocker mechanism can also be considered. The insole should provide support to the longitudinal arch by an arch-support, to the transverse arch and the metatarsal heads by a metatarsal button, and it should add stability to the heel with a heel cup. Signs of collapse of the longitudinal arch can be detected by measuring a decreasing projection height of the medial malleolus of the weight bearing foot. In an early stage of claw toes, when the toes are still mobile, a tendon transfer is possible to prevent further clawing of the toes ([13]).

Limitations of the PGT and recommendations for improvement. The lack of another reliable, non-invasive clinical test that measures intrinsic muscle strength with which the PGT could be compared, is a limitation of this research. Because we could not compare the PGT to another test, it was not possible to assess the sensitivity of the PGT. The only reliable gold standard would be needle electromyography, which we did not use in this study. Surface electromyography showed not only electromyographic activity in the intrinsic muscles, but also in the long muscles of the toes. But, by assuring normal strength of the long flexors in all our subjects, a positive PGT caused by weak extrinsic muscles is excluded.

The first examiner performed the inclusion of patients and PGTs so the outcome of the PGTs was potentially vulnerable to information bias due to a knowledge of variables as leprosy/non-leprosy and type of leprosy. During examination of the foot this examiner also became aware of ulcerations of the foot. This bias was limited by emphasizing that all subjects should give as much pressure to the paper slice as they possibly could.

False-positive PGTs may generally be caused by weak muscle power and/or a person's misunderstanding of the test procedure. This may also explain the higher percentages of positive PGTs in older people and females in both the leprosy and the control groups. Moreover, females were less inclined to give firm resistance with their feet in reaction to the pulling of the paper.

A relatively high proportion of feet from leprosy-affected persons with no loss of plantar sensibility was found to have positive PGTs (PGT1 10.7%, PGT2 23.1%). Partially this could be explained by false-positive results of the PGTs, but in the control group the proportions of positive PGTs are significantly lower. This could probably be explained by the relatively low sensitivity of the 10 gram monofilament sensibility test for mild sensibility loss of the footsole. More sensitive sensibility testing, with a 2 gram monofilament, for example, should be performed in these patients. Also, sensibility was regarded as normal when a patient was able to indicate all three regions of pressure stimulus with their eyes closed at least one out of three times. This will not eliminate some errors due to guessing and this could lead to an underestimation of sensibility loss in the leprosy group.

The exclusion of patients with foot deformities gives an underestimation of the percentage of leprosy patients with intrinsic muscle weakness. It is likely that the majority of them have paralysis of intrinsic foot muscles.

The influence of the use of different types of paper slips and different types of underground is not investigated in our study. When the paper slip used is too thin, the tearing point of the paper will become critical to identifying the threshold for a negative test; therefore, we recommend standardization of the paper quality and paper size. We would advise the size and type of paper used for business cards (at least 100 g/m^2), because this paper will not easily tear and is widely available. Also the direction and rate of force, the area where the force is applied to the paper and testing surface could probably influence the outcome of the PGT. Again, we recommend standardization of these as a further objective of this study.

It would also be interesting to correlate the PGT results with additional variables, such as presence of ulcer/scar at certain sites and site of anesthesia to increase the validity of the PGT.

SUMMARY

Plantar intrinsic foot muscles provide structure to the foot during walking and thus regulate mechanical foot sole stresses. When paralyzed, for instance in leprosy patients

with neuropathy of the distal part of the tibial nerve, there is a high prevalence of plantar ulceration and deformities, especially when muscle weakness goes together with loss of foot sole sensibility. These patients should get immediate care involving education, special footwear and reconstructive surgery before further foot impairment and deformity becomes manifest. Thus far, in leprosy patients little attention is paid to screening of plantar intrinsic muscles activity. This can be done with a new simple and non-invasive method, the Paper Grip Test (PGT). There are two variants for detecting intrinsic muscle weakness of the foot, PGT1 for the great toe and PGT2 for the combined lesser toes.

In this study, 517 leprosy patients and 170 healthy volunteers were investigated with the PGT. Sensibility of the foot sole was tested by means of a 10 gram monofilament. Specificity to the PGT1 is found to be about 95.3% which is considered good for physical diagnostic tests. PGT2 is less specific than PGT1. Individual muscle power and understanding of the patient seems to influence the outcome of the test to a certain extent. Sensitivity can only be calculated when the diagnosis is confirmed by electromyography.

Especially patients with anesthetic feet, females, older patients and patients with PN-, BB- or LL-types of leprosy appeared to have a higher prevalence of intrinsic foot muscle weakness. All results were analyzed by means of the bivariate Pearson correlation-analysis and proved to be statistically significant ($p = <0.05$). It is concluded that the PGT1, more than the PGT2, is a useful screening test on the function of plantar intrinsic foot muscles in leprosy patients in hospitals and during fieldwork in developing countries.

RESUMEN

Los músculos plantares intrínsecos del pie proporcionan la estructura requerida para caminar y regulan el estrés mecánico de la planta del pie. Cuando se paralizan, por ejemplo en los pacientes con neuropatía de la parte distal del nervio tibial, ocurre una alta incidencia tanto de ulceras plantares como de deformidades, especialmente cuando la debilidad muscular está asociada con la pérdida de sensibilidad plantar. Los pacientes con debilidad de los músculos plantares intrínsecos del pie deben recibir atención inmediata, incluyendo educación, calzado especial y cirugía reconstructiva, antes de que la disfunción y deformidad se hagan aparentes. Hasta ahora se ha dado poca atención al examen de la actividad de los músculos intrínsecos plantares en los pacientes con lepra. Sin embargo, el examen puede hacerse con un método simple y no invasivo referido como la prueba de sujeción del papel o *Paper Grip Test* (PGT). De este método existen dos variantes, la PGT1 para el dedo grande del pie y la PGT2 para el conjunto de los dedos pequeños.

En este estudio, se investigaron 517 pacientes con lepra y 170 voluntarios sanos con la prueba PGT. La sensibilidad de la planta del pie se probó usando un monofilamento de 10 gramos. Se encontró que la especificidad de la PGT1 fue del 95.3%, lo cual se considera bueno para pruebas de diagnóstico físico. La PGT2 es menos específica que la prueba PGT1. La potencia de los músculos individuales y el trato a los pacientes, parecen influir, en cierto grado, en el resultado de la prueba. La sensibilidad sólo se puede calcular cuando el diagnóstico se ha confirmado por electromiografía.

Los pacientes con pie anestésico, los pacientes femeninos, los pacientes viejos y los pacientes con lepra PN, BB o LL mostraron una alta frecuencia de debilidad de los músculos intrínsecos del pie. Todos los resultados se analizaron usando el análisis de correlación bivariado de Pearson y fueron estadísticamente significativos ($p <0.05$). Se concluye que la PGT1, más que la PGT2, es una prueba útil para la exploración de la función de los músculos intrínsecos del pie en los pacientes con lepra y que es aplicable tanto en los hospitales como en el trabajo de campo, en los países en desarrollo.

RÉSUMÉ

Les muscles plantaires intrinsèques garantissent le maintien structurel du pied lors de la marche et régulent ainsi les stress mécaniques plantaires. Lors de paralysies, comme par exemple lorsqu'un lépreux présente une neuropathie de la partie distale du nerf tibial, une forte prévalence d'ulcérations plantaires et de déformations est observée, en particulier lorsqu'une faiblesse musculaire est accompagnée d'une perte de sensibilité de la plante du pied. Ces patients doivent sans délais bénéficier de soins comprenant une information spécifique et des chaussures spécialisées, ainsi qu'une chirurgie réparatrice avant que le handicap et la déformation du pied ne deviennent trop marqués. Jusqu'à présent, les patients hanséniens n'ont bénéficié que de peu d'intérêt pour un dépistage de l'activité des muscles plantaires intrinsèques. Cela peut maintenant être réalisé au moyen d'une méthode simple et non-invasive, le test de préhension du papier (PGT). Il y a deux variantes de la méthode pour détecter les faiblesses des muscles plantaires intrinsèques : PGT1 pour le gros orteil et PGT2 pour les autres orteils.

Dans cette étude, 517 patients hanséniens et 170 volontaires sains furent étudiés au moyen du test PGT. La sensibilité plantaire fut évaluée à l'aide d'un monofilament de 10 grammes. La spécificité du test PGT1 est d'environ 95,5%, ce qui est considéré comme satisfaisant parmi les tests physiques de diagnostic. PGT2 est moins spécifique que PGT1. La force

musculaire interindividuelle et la compréhension du patient semblent influencer dans une certaine mesure le résultat du test. La sensibilité de la technique ne peut être calculée que lorsque le diagnostic est confirmé par électromyographie.

Une prévalence plus élevée de faiblesse des muscles plantaires intrinsèques était notée chez les patients avec des pieds anesthésiés, les femmes, les patients âgés et ceux souffrant de lèpre de type PN, BB et LL. Tous les résultats furent analysés à l'aide d'un test de corrélation à deux variables de Pearson et étaient statistiquement significatifs (p = <0,05). En conclusion, PGT1, plus que PGT2, est un test de dépistage utile pour le dépistage de l'altération fonctionnelle des muscles intrinsèques du pied parmi les patients lépreux hospitalisés ou bien dans les actions sur le terrain dans les pays en voie de développement.

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