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Pachydermodactyly From Repetitive Motion in Poultry Processing Workers

A Report of 2 Cases

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Background: Pachydermodactyly is a rare, benign, acquired form of digital fibromatosis. The etiology of pachydermodactyly is unknown but is believed to be due to repeated mechanical injury of the skin. We report 2 cases identified in poultry processing workers and review other conditions associated with these cutaneous findings.

Observations: The 2 workers in this report were employed as a chicken catcher and a chicken hanger. On examination, both workers had marked lateral thickening of the digits, with associated pain and pruritus. The workers' skin condition developed despite the use of protective gloves, and their symptoms improved when removed from work. However, the swelling due to fibromatosis persisted.

Conclusions: Similar cutaneous findings have been reported in other occupations exposing individuals to repetitive skin trauma, and many patients demonstrating a compulsive habit of hand manipulation. This supports the conclusion that pachydermodactyly in these patients reflects repeated skin trauma. Repetitive mechanical injury in the poultry processing environment can result in considerable compensatory tissue changes. Preventive measures are needed to protect workers.

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PACHYDERMODACTYLY IS A rare, benign, acquired form of digital fibromatosis. It is clinically characterized by an asymptomatic soft-tissue swelling of the lateral aspects of the proximal interphalangeal joints of the fingers. Most reported cases involve young, otherwise healthy males, with a mean age of 21.2 years.¹⁻⁵ However, reported ages have ranged from 5 to 69 years.¹

The pathogenesis of pachydermodactyly is unknown but is believed to be due to repeated mechanical injury of the skin.^{2,3} Poultry processing workers are exposed to repetitive minor trauma. Herein, we report cases of 2 men with marked changes of the fingers identified in a study of occupational skin diseases in poultry processing workers, and we review other occupations associated with pachydermodactyly. These cases were observed in a community-based survey of poultry processing workers. The data presented herein were collected from a physical examination and a questionnaire provided to the workers. Pichardo-Geisinger et al⁶ describe in more detail the data collection process. All the data collection and informed consent procedures were approved by Wake Forest School of Medicine institutional review board.

The illness and injury rate in poultry processing is among the highest in food manufacturing.⁷ To meet the demand, the industry has been vertically integrated and mechanized.⁸ The capacity to meet the demand for chicken is dependent on the ability to make the production lines as efficient as possible. The process starts in the chicken houses, where 10 000 to 25 000 chicks are raised for about 6 to 8 weeks until they are grown and ready to be taken to the processing plant.^{9,11} To transport the chickens to the processing plant, catchers gather the chickens and put them into small cages. After arrival at the plant, the live chickens are dumped on a conveyor belt that takes them into a dark and humid room where workers hang them by their feet on shackles. Next, the birds are stunned and beheaded by a machine, and then taken to another machine that removes the feathers. Finally, the birds are eviscerated, deboned, and packed. Each stage of the process is completed at an average speed of one bird per worker every 2 seconds.¹² The average plant in the United States processes 250 000 chickens per day.⁹ The magnitude at which production takes place exposes workers to different animal byproducts,

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Figure 1. The hands of a chicken catcher, who has worked in poultry processing for 8 years. Soft-tissue swelling of the lateral aspects of the proximal interphalangeal joints of the middle and ring fingers.



Figure 2. The hands of a chicken hanger, who has worked in poultry processing for 3 years. Soft-tissue swelling of the lateral aspects of the proximal interphalangeal joints of the middle and ring fingers.

extreme environments, repetitive movements, prolonged periods of standing, and employer pressure to perform the job at a fast pace.¹³

REPORT OF CASES

CASE 1

A 33-year-old Hispanic employee of a poultry processing plant reported a history of chronic pain, pruritus, erythema, paresthesias, and urticaria of his hands. The pain was located diffusely in his hands and was worse when performing specific activities. On a scale of 1 to 5, with 5 being the most severe, the cumulative severity of his hand symptoms was subjectively noted to be a 4 at its worst. His symptoms had interfered with his normal social activities and were noted to be a problem at work. He also reported bilateral wrist, elbow, and shoulder discomfort. On examination, the patient was observed to have marked lateral thickening of the digits (**Figure 1**).

Occupationally, he has worked as a chicken catcher for a poultry processing plant 9 hours a day for the past 8 years. His job requires him to perform repetitive tasks with his hands and fingers. Protective gloves are worn at all times in attempt to minimize hand trauma. The worker also reports that he washes his hands several times per day. His symptoms improve when he does not work for several days.

CASE 2

A 42-year-old Hispanic employee of a poultry processing plant reported a history of pain and pruritus of his hands and similar trophic changes of the digits (**Figure 2**). These symptoms were associated with mild paresthesias, weakness, and stiffness, and were worse with job-related activities. On a scale of 1 to 5, with 5 being the most severe, the patient subjectively reported the severity of his cumulative symptoms to be a 3 at their worst. His symptoms limited his ability to do his job and interfered with social and leisure activities. He also reported bilateral wrist, shoulder, and lower back pain.

Occupationally, this person has worked as a chicken hanger 8 hours a day for the past 3 years. His job requires him to perform repetitive tasks with his hands and spend all 8 hours per day working with chickens. Despite wearing protective gloves, contact with live chickens at work exacerbates his skin condition. The worker reportedly washes his hands several times per day. The worker notes improvement in his symptoms of pain, pruritus, and paresthesias when he is removed from work for several days.

COMMENT

Pachydermodactyly is a rare benign form of digital fibromatosis characterized by a painless symmetrical swelling of the tissues surrounding the proximal interphalangeal joints. The first reported case of pachydermodactyly was by Bazex et al³ in 1973, and the condition was later named by Verbov in 1975.¹⁴ Pachydermodactyly mostly occurs in young people with a mean age of 21.2 years and at a male to female ratio of 3:2,^{1,3} although, the male to female ratio has been reported as high as 5:1.^{2,15} The male predominance may reflect the sex distribution of the causative occupations and medical conditions associated with tics. However, some authors believe the female prevalence may be underestimated.^{15,16} The affected individuals are usually otherwise healthy, although pachydermodactyly has been associated with Dupuytren contracture, Asperger syndrome, carpal tunnel syndrome, and tuberous sclerosis.¹⁶⁻¹⁹

Histologically, pachydermodactyly is characterized by orthokeratotic or parakeratotic hyperkeratosis, acanthosis, and thickening of the dermis owing to an increased amount of fibroblasts and collagen types III and V.¹⁵ Electron microscopy has found the collagen to be of a finer diameter in comparison with its appearance in normal tissues. There is usually minimal or no inflammation.

The etiology of pachydermodactyly is unknown. However, some authors believe the cause to be repetitive exogenous minor traumas.¹⁻⁵ Occupations that involve repetitive mechanical injury, such as chicken catching and chicken hanging, therefore may predispose to this condition. Because pachydermodactyly is characteristically asymptom-

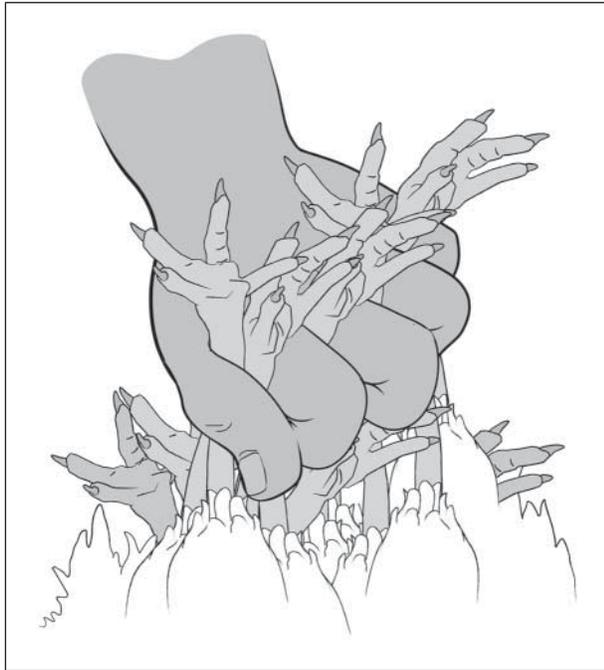


Figure 3. Interaction of a chicken catcher's hands with chickens.

atic, the pain, pruritus, and paresthesias reported by these workers are likely the result of this repetitive trauma, and not directly from the pachydermodactyly itself.

Chicken catchers, the occupation of the worker in case 1, are responsible for grasping the legs of 5 to 7 live chickens in each hand and subsequently loading them into metal crates for transportation to a processing center. This is accomplished by a team of 7 to 10 catchers, who first herd the chickens into a small area of the wet, dirt-floored chicken house. Afterward, the catchers pick up as many chickens as possible by scooping their hands underneath the chickens, allowing for the chickens' legs to insert between their fingers (**Figure 3**). The catchers then carry the chickens inverted to the transport cage, while the chickens peck and scratch their hands. A team catches a total of 30 000 to 60 000 chickens per day.¹¹ The job is fast paced, and the workers are paid per barn rather than per hour. Although the catcher described herein wore gloves, he still developed cutaneous lesions. Often catchers do not wear any hand protection because they believe it makes catching the chickens more difficult and thus more time consuming. The difficulty of quickly carrying and loading multiple live chickens creates the opportunity for repetitive mechanical injury to the catchers' hands.

Chicken hangers, the occupation of the worker in case 2, are responsible for suspending live chickens on an overhead conveyor. This is accomplished by grabbing the birds by their feet and sliding their legs into W-shaped metal shackles on an overhead moving conveyor belt (**Figure 4**). The job is fast paced, because hangers are expected to hang on average 1 chicken every 2 seconds¹² for 2 hours. After every 2-hour work shift, they receive a break. This work-break cycle is continued until the completion of their 8-hour work day. The chicken hanging task subjects workers' knuckles to repetitive contact with the metal shackles and trauma inflicted by the live birds. Despite the use of pro-

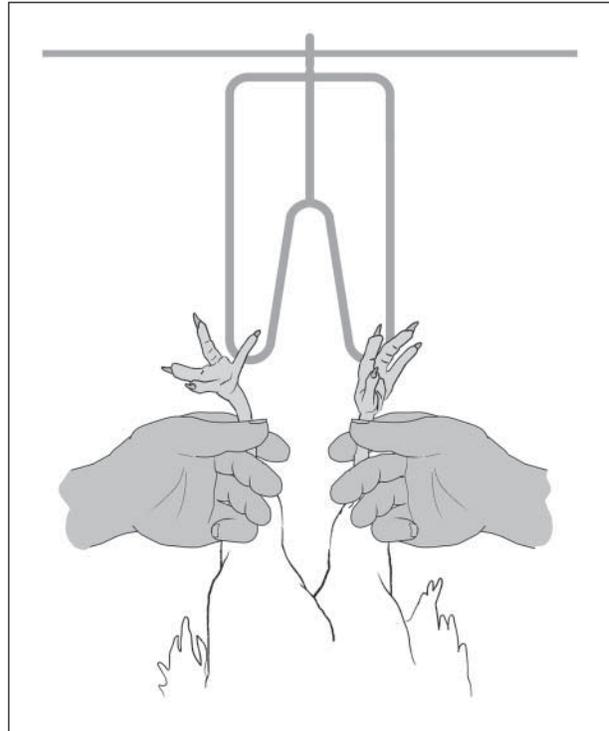


Figure 4. Illustration of interaction of a chicken hanger's hands with chicken and equipment.

TECTIVE GLOVES, the worker still developed cutaneous lesions. However, as with chicken catchers, chicken hangers do not always wear finger protection, as it can interfere with their ability to perform the job.

The term pseudo-knuckle pad has been used to describe a callosity that develops after repeated skin irritation.²⁰ In contrast, knuckle pads are not believed to be linked to trauma. The distinction between pseudo-knuckle pads and pachydermodactyly is the location of skin swelling; whereas pachydermodactyly involves predominantly the lateral proximal interphalangeal joint surface, pseudo-knuckle pads involve the dorsal surface.²¹ Owing to the similarity, pachydermodactyly has been hypothesized to be a variant of knuckle pads.⁴ Their precise pathogenesis remain largely unknown.

Richards et al²² reported a 56% prevalence of painless knuckle pads in live-chicken hangers in a poultry processing plant. The most common locations were the proximal interphalangeal joints and metacarpophalangeal joints, with 96% being bilateral and 83% involving symmetric locations. Despite the workers' use of protective cotton gloves, the authors attributed these cutaneous findings to repetitive trauma endured from contacting workers' fingers against the W-shaped metal shackles. Although the term *knuckle pad* was used to describe the lesions, they were attributed to trauma and thus in current terminology would be classified as pseudo-knuckle pads.

Pseudo-knuckle pads have also been reported in tailors, granite cutters, barbers, leather stackers, gardeners, and boxers.²³ These occupations represent additional lines of work that expose individuals to repetitive mechanical injury. Thus, pseudo-knuckle pads and pachydermodactyly may represent 2 cutaneous conditions with similar etiologies.

Pachydermodactyly has been reported in individuals demonstrating a compulsive habit of hand manipulation.^{1,3,5,15,16,24,25} Pereira et al¹ reported the case of an individual with pachydermodactyly who affirmed that his lesions were the result of repetitive hand-in-hand contact. Finger interlacing, gripping, and rubbing represent habits that expose the index, middle, and ring fingers to exogenous friction. These motions are more prominent in people with obsessive-compulsive disorder, and thus those individuals may be at higher risk for pachydermodactyly. Calikoğlu²⁴ reported a case of an adolescent male who presented with diffuse cutaneous thickening and hyperpigmentation along the metacarpophalangeal joints. These findings were attributed to repeated mechanical injury secondary to a ticlike habit of rubbing his hands together. In light of the apparent association of pachydermodactyly with ritualistic behaviors, physicians should consider these lesions as a possible sign of an underlying psychiatric condition.

In this report we present 2 cases of pachydermodactyly in poultry processing plant employees. We believe the dramatic morphologic changes in the digits that we observed to be indicative of the degree of repetitive trauma inherent in poultry work and of the body's adaptive response to that trauma. If our hypothesis is true, analysis of how different workers perform these tasks is warranted. If these workers are typical, possible preventive measures to decrease the incidence of this cutaneous condition include decreasing the amount of chickens handled per day and modifying the surfaces that the employees' hands repetitively contact. Such modifications may include changing the shape of the W-shaped metal shackles, decreasing the speed of the conveyor belt, enlarging the chicken crate openings, or adding a soft protective liner to commonly contacted surfaces. These modifications may limit repetitive mechanical injury to the skin and thus impede the development of pachydermodactyly. Because the demands of production in poultry processing likely limit the possibility of reducing line speeds or reducing chickens handled per day, job rotation could be considered as a way of limiting repetitive trauma. In conclusion, poultry processing represents one occupation that predisposes employees to pachydermodactyly.

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