

# Telemedicine Success in the United States Associated Pacific Islands (USAPI): Two Illustrative Cases

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## ABSTRACT

A simple technical solution to a difficult situation serves as a model for telemedicine in the developing world of the Pacific Rim. Reported here are two cases involving little girls who accidentally suffered broken legs and how they were helped. The first, a 6-year-old from Kolonia, Pohnpei State, Federated States of Micronesia, fell out of a second story window and broke her left leg. The second, a 5-year-old girl from Majuro, Republic of the Marshall Islands, was hit by an automobile and suffered a fracture of her left leg. These two cases illustrate the utility of simple-store-and-forward telemedicine technology in distance consultation, referral, and education.

## INTRODUCTION

THE PACIFIC ISLAND HEALTH CARE PROJECT (PIHCP) is a congressionally funded program that provides definitive medical care to the medically underserved peoples of the United States Associated Pacific Islands (USAPI), formally the United States Pacific Trust Territories. Under the provisions of the law and the compact, peoples of the USAPI are authorized medical care in military treatment facilities on a reimbursable basis. Patients who provide unique Graduate Medical Education (GME) opportunities for residents-in-training are treated at Tripler Army Medical Center (TAMC) at no cost to the patient, family or jurisdiction under the auspices of the PIHCP. The only exception being a babe-in-arms, in such cases the mother is provided the airplane seat. All attendant medical expenses are borne by the program. In the case of patients who re-

quire additional support such as oxygen, intravenous access or a stretcher, additional seats are reserved. In the case of children in traction six seats must be purchased. In the rare instance of an adult on a ventilator, as many as nine to 12 seats must be reserved. Roundtrip airfare varies with distance from the jurisdiction, but the average cost is approximately \$1,800 to \$2,000. For planning purposes, and based on historical experience, the average cost of travel and medical expenses for Pacific Islanders is approximately \$25,000. Many patients can be treated for much less while others may run up expenses in excess of \$250,000.

Prior to the development of the Internet-based consultation and referral web site (pre-December 1997) TAMC provided in excess of \$8 million in non-reimbursed care annually.

For a number of years, the senior leadership at TAMC supported evolving technologies in an attempt to bridge the formidable barriers of

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time, distance, language, and lack of infrastructure (in the distant jurisdictions).

That program has provided medical care to over 4,000 Pacific Islanders since 1990. Additional patients have been treated on a reimbursable basis.<sup>1,2</sup> As telemedicine technologies evolved at TAMC, and with the distant practitioners access to the Internet, the time was right to develop a simple web-based, store-and-forward format. Since the first referral in December 1997 and without interruption until the present, it has continued to provide these distant physicians with consultations, referrals, education and collegiality, previously unattainable.

## CASE REPORTS

### *Case 208*

A 6-year-old girl fell from the window of a two-story house in Kolonia, Pohnpei State, Federated States of Micronesia, on August 25, 1998. She struck the ground on her left side and experienced immediate and severe pain in her left hip. She has mild bruising over the left temporal area, but did not lose consciousness. On examination within an hour of the injury in the Emergency Department of Pohnpei State Hospital, the child appeared pale, but was alert, and her vital signs were normal. She had obvious swelling and tenderness of her left thigh. An x-ray confirmed a high subtrochanteric fracture of the femur with marked displacement (Fig. 1). Skull and chest x-rays were normal, and her hemoglobin was 9.4 g/dL. She was transfused with one unit of whole blood. The hospital has limited resources, no orthopedic surgeon, no fracture table, and no equipment or x-ray capability for open reduction and internal fixation for such a fracture in a child.<sup>3</sup>

The surgeon detailed his concerns and difficulties in dealing with such a fracture. A Steinmann pin was inserted in the distal femur. With available materials, he improvised traction to effect reduction of the severely displaced fracture (Figs. 2 and 3).

Specific questions directed to the pediatric orthopedic consultant related to positioning and adequacy of the reduction. The consultant's response follows:

From: (Medical Director of Pacific Health-Care Program)—Hawaii

Date: 09/01/1998 12:00 AM

Comments: Forwarded case

From: (Orthopedist)—Hawaii

Date: 09/02/1998 12:00 AM

Comments: The photograph notes excellent initial treatment; it is unclear to me what is under the heel of the leg in traction—I would recommend that it is free that a decubitus may be avoided. The radiographs in traction are a little difficult to discern, but it appears the fracture is in extension and under-distracted. I would recommend beginning with about 1/6th of the body weight for the traction pin and follow x-ray with cross table lateral and AP of the femur, not pelvis. Also, the position with 90 degrees hip flexion is good; I would worry little of the abduction and add slight external rotation.

From: (Staff Physician)—Pohnpei

Date: 09/04/1998 12:00 AM

Comments: Thank you very much for your excellent comments. The heel is resting on the support, but I will certainly create a hole to free the heel. The weight on traction is currently at 2 kg or 4.4 lbs, and as you have suggested, I will increase the weight to 1/6th body weight. One big problem I have here is that our portable x-ray machine is not functioning well, and thus the portable films are certainly of poor quality. I will certainly correct the abduction as well.

Thank you very much for your valuable comments.

I have noted from literature about the difficulties in reducing this type of fracture by external means, and that even with ORIF, no device has been made for this type of fracture.

Again, thank you very much.

Aloha.



FIG. 1. Prereduction film (anteroposterior view).

From: (Medical Director of Pacific Health-Care Program)—Hawaii  
Date: 09/04/1998 12:00 AM

Comments: This is the way I hope we can exploit our electronic interactions! What a great case and excellent supporting images! You are to be complimented too! Best.

From: (Staff Physician)—Pohnpei  
Date: 09/06/1998 12:00 AM

Comments: Thank you very much for those kind words.

After correction of the position, the young girl is almost asymptomatic now.

Thanks so much.

After minor adjustments in positioning, traction and freeing her heel, the child was virtually asymptomatic (Fig. 4).

#### Case KG2371

Following a motor vehicle accident on August 26, 2001, a 5-year-old girl was admitted to Majuro Hospital, Majuro, Republic of the Marshall Islands. She was diagnosed with a closed fracture of the left femoral shaft (Fig. 5). Skeletal traction (improvised orthopedic frame) was accomplished using a Steinmann pin in the distal femur and her knee and hip were maintained at 90 degrees of flexion. The surgeon indicated that the child was comfortable in traction (Fig. 6).

Postreduction films (Fig. 7) were attached, and the TAMC orthopedic surgeons were consulted with regard to the adequacy of the reduction and the alignment of the bony fragments. The interactive comments follow:

From: (Medical Director of Pacific Health-Care Program)—Hawaii  
Date: 09/01/2001 8:21 PM



FIG. 2. Child in traction.

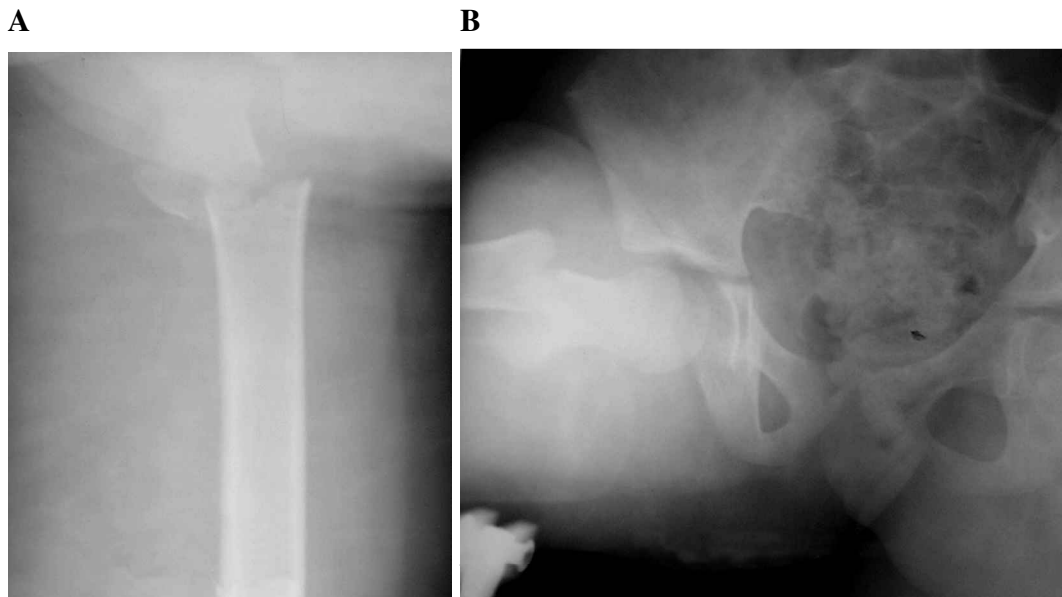


FIG. 3. A. Postreduction film (lateral view). B. Postreduction film (posteroanterior view).

Comments: Forwarded case

From: (Medical Director of Pacific Health-Care Program)–Hawaii  
Date: 09/01/2001 8:22 PM

Comments: Forwarded case

From: (Staff Physician)–Majuro  
Date: 09/04/2001 2:10 AM

Comments: Dear Drs.,

Visiting Orthopedic team already saw this child today. The traction is very satisfactory. Also they are of the view that the alignment is OK as it is now. In fact, they reminded me that the accurate alignment or over reduction may lead to discrepancy in limb lengths later on. Personally, I am very happy to hear from TAMC Drs that the improvised (Majuro Style) traction frame does the job for the patient. Yes!!! It took me half a day and a trip to the local store to get the stuff organized, but it worked out. Thanking you.

From: (Medical Director of Pacific Health-Care Program)–Hawaii

Date: 09/04/2001 12:27 PM

Comments: I was impressed and you are to be congratulated!

From: (Orthopedist)–Hawaii  
Date: 09/10/2001 8:56 AM

Comments: I concur, the alignment is perfect. Weekly x-rays in traction will be helpful to assure that the fracture is not over-distracted with time as the muscle atrophy occurs. Optimal is 1–1.5 cm overlap. In 3



FIG. 4. Child in traction in the pediatric ward, Pohnpei State Hospital.



FIG. 5. Left femur (posteroanterior view).

weeks or so, adequate callus will form and allow a transition to a  $1\frac{1}{2}$  hip spica cast if desired. Otherwise 6–8 weeks of traction will suffice.  
Excellent.

## DISCUSSION

A number of observations are in order and while some are obvious (i.e., transportation and

cost savings), others are more subtle (i.e., disruption of the family, separation, professional isolation, culture).

These are but two of the now nearly 1,600 cases that have been consulted or referred from the USAPI. The web-based, store-and-forward technology has worked remarkably well in the austere, tropical, insular states of the Pacific. Bandwidth is limited, and infrastructure is inadequate. Limited resources for healthcare in the jurisdictions are chronically inadequate and the privileged few are referred “off island” at great expense to the overall health budgets of the jurisdictions.<sup>2</sup>

The cases of these two little girls are examples of what can be accomplished by physician champions<sup>3,4</sup> of a telemedicine system that is responsive to their needs and those of their patients. In both cases, the referring providers attached radiographs of the fracture site, both pre- and postreductions. They each innovatively designed the traction with what they could find in the hospital or “local store.” In the case of the child from Pohnpei, the photograph of the child allowed the pediatric orthopedist at TAMC to recommend increase of traction weight ( $1/6$  the child’s body weight), increase the external rotation at the hip and cut out the canvas under the heel to prevent the development of pressure sores. In the case of the little girl in Majuro, the referring physician developed his own unique traction bed, transmitted pre- and postreduction films as well as a photograph of the child in her bed postop-



FIG. 6. Child in traction in recovery room in Majuro Hospital.



FIG. 7. A. Postreduction film (posteroanterior view). B. Postreduction film (lateral view).

eratively. The resulting reduction was excellent. There is a paucity of literature available in the developing world with regard to orthopedic treatment in austere settings,<sup>5</sup> and that which is written is unobtainable in the bush.

Using the DRG 211 for “fracture hip/femur, under 17 years of age” the cost would be as indicated in Table 1.

TABLE 1. COSTS FOR A CHILD WITH A FEMUR FRACTURE (DRG/211)

<b>FY 1998</b>	
\$9,736.40	Inter-agency rate
\$10,389.59	Third party rate
<b>FY 2000</b>	
\$14,293.77	Inter-agency rate
\$15,093.58	Third-party rate

Based on the above figures and adding the airfare (minimum \$5,000), a cost savings of approximately \$20,000 was realized.

It is interesting to consider the rest of the story regarding these two little girls:

- Many families in the Pacific include several children, and the mother’s absence would be disruptive to the family.

- Many live on distant atolls or at great distance in the depths of the jungle.

In a recent analysis of the PIHCP web site, it is apparent that nearly 75% of patients are for consultation only.<sup>6</sup> Physicians in the remote jurisdictions prefer to take care of the majority of their patients locally. Nowhere was this more evident than the case of these two little Micronesian children. Cost savings for each case would have easily paid for two workstations!

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