The Republic of Palau and the Pacific Island Health Care Project (PIHCP)

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Abstract:

Physicians from the Republic of Palau have participated in the Pacific Island Health Care Project (PIHCP) sponsored by Tripler Army Medical Center (TAMC) since the projects inception in 1990. The PIHCP was developed to provide exceptional graduate medical educational (GME) benefit to physicians-in-training at TAMC while at the same time to supply the medically underserved indigenous peoples of the United States Associated Pacific Islands (USAPIs) with advanced medical and surgical care. Coordination and management of patient referrals utilizing standard means (telephone, fax, letter) had become virtually impossible. A patient referral submitted via the Internet in December 1997 to the PIHCP from Palau was the stimulus needed to develop a telemedicine solution to the whole referral process. With the technical assistance of Project Akamai and the support of the US Congress, I was able to develop a simple, store-and-forward platform for the consultation and referral of patients from the USAPIs to TAMC. Since that time 2500 cases have been submitted to the PIHCP. Of those cases 511 have been from Palau. Palau, a country of about 20,000 or 4% of the total population of the USAPIs (>500,000) submitted >20% of the cases. A spectrum patients with of well described, well documented disease conditions has been provided by the physicians from Palau. Many cases have supporting imagery. Both sexes and all ages are well represented. Patients with cancer lead the list of referred patients. For the last several years the PIHCP provided Palauans with nearly $1,000,000 annually in medical care. The long and collegial relationship between the Republic of Palau and TAMC has been rewarding. This relationship has been strengthened by the PICHP. (PHD, 2005 Vol 12 No 1 Pages 132 - 140)

Introduction and Background

More than fifteen years ago, several of the clinical leaders and teaching chiefs at Tripler Army Medical Center (TAMC) recognized the unique potential of Pacific Islanders to the training of our residents. Major General Gerard Sider, the then Commander, was petitioned with a plan to access a limited number of selected patients from the United States Associated Pacific Islands (USAPIs) for the purpose of enhancing the Graduate Medical Education (GME) experience for the residency training programs at TAMC. The congressional delegation was approached and under the aegis of the Senior Senator from Hawaii, the Honorable Daniel K. Inouye, the United States Congress appropriated $500,000 in 1989 for travel for Pacific Island patients from their home jurisdictions to TAMC and return. From the beginning I have been privileged to have been involved in this unique endeavor and for the past fifteen years I have served as Medical Director of the PIHCP. Various regulations of the Departments of State, Defense and the Army permit medical care for the indigenous peoples of the USAPIs at military medical treatment facilities on a reimbursable basis. For a number of reasons, beyond the scope of this discussion, that arrangement never worked well.

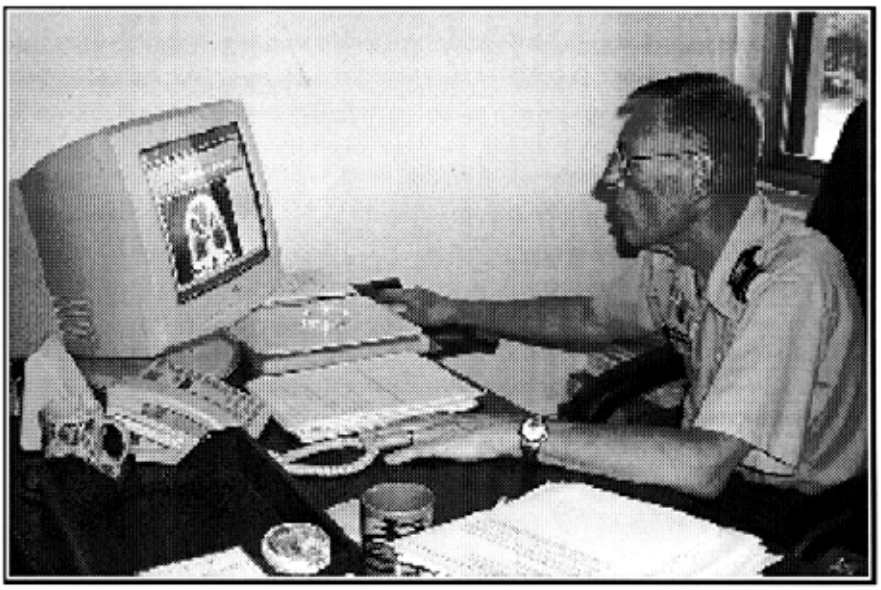
The history of the PIHCP is inexorably linked to the Pacific Basin Medical Officers Training Program (PBMOTP) and its Director, Gregory J. Dever, MD, currently the Director of Clinical Services, Ministry of Health, Republic of Palau and to the Pacific Basin Medical Association (PBMA) and its first president Victor M. Yano, MD, currently Minister of Health, Republic of Palau. Many of the referring physicians from the jurisdictions to the PIHCP are graduates of the PBMOTP.

Figure 1. First telemedicine consultation in the Pacific. Author on the Picasso telephone (Pohnpei-Palau)

Early consultations and referrals were fraught with the many problems of time and distance, an International Date Line, five time zones and the massive expanse of the Pacific Ocean. Communication was by International telephone, FAX, airmail, and in very special cases, even diplomatic pouch! From the beginning Palau has been uniquely linked to the PIHCP. A variety of initiatives were developed in an attempt to streamline the consultation/referral process from the jurisdictions to TAMC. Both Yano and Dever were prime movers in the development of the web-based evolution of the PIHCP moving it from the traditional model of the 20th century into the 21st century.

As new technologies developed they were applied to the PIHCP in the USAPIs and project Akamai at TAMC. The later was a telemedicine technology initiative at TAMC. Real time interactive video telecosultation was demonstrated between Kwajalein Island in the Marshall Islands and TAMC in the early 1990s 1. The technological infrastructure, band width, cost and complexity precluded any possibility of such applicability to the developing world of the Western Pacific. As the first president of the PBMA, Dr. Yano continued to apply new methods of referral and consultation as well as methods of continuing education for the physicians of the jurisdictions, the members of the PBMA, and graduates of the PBMOTP. At the 1st Annual Meeting of the PBMA in 1994 in Pohnpei State, Federated States of Micronesia, a group of us from TAMC demonstrated the Picasso telephone. While waiting for a connection with TAMC for a lecture on HIV/AIDS by Arthur (Ace) Johnson, MD (Infectious Disease Consultant at TAMC) serendipity allowed me to use that opportunity to consult on a mutual patient of Yano's and mine who lived in Palau. She was called into the hospital in Palau, which also had a Picasso telephone and was a part of that morning's telemedicine demonstration. Within minutes we were connected and I was observing images of the patient and simultaneously, telephonically queried her about her symptoms and medication side effects (Fig.1). Based on that interaction I was able to make recommendations regarding dosage changes and obviated a very expensive transfer from Palau to TAMC2. Subsequently, Dr. Dever used the Picasso phone for the purpose of medical education for the students of the PBMOTP and effectively conducted medical grand rounds between the PBMOTP and TAMC pediatrics. The Picasso phone preformed well in a number of demonstration projects. The limiting factor in its utility in the Pacific Basin was the expensive long distance toll charges in the Western Pacific. Charges of $5-$10 per minute were prohibitive in the inadequately funded jurisdictions of the USAPIs. Additionally, American Telephone and Telegraph stopped production of the Picasso phone at one point in the 1990s. Subsequently it was surpassed by newer technologies.

Figure 2. Author viewing CT scan from Palau



In the summer of 1997, Drs. Dever and Joe Flear referred a child to me using the Internet3. Unfortunately I was unable to visualize the attached images of a baby with a massive henangioma of the cheek using the only computer system (CHCS) available at TAMC at the time. I sought out the technical expertise of Project Akamai and by December 1997 I was able to visualize consultations from practitioners in the Western Pacific using the Internet. The first few cases were submitted by Dr. Yano, the first was received by me on 7 December 1997. Although the first several months of consultations required labor intensive manipulations, ultimately, I settled on a simple store-and-forwarded platform for the PIHCP (Fig. 2)4. Because of the interest and involvement of Palauan physicians with the PIHCP, it seems appropriate to review our long association. This review includes the first 2500 cases submitted on-line to the PIHCP (7 December 1997 – 13 July 2005). Of those, more than 500 cases have been from Palau.

Materials and Methods

Four telemedicine work stations were originally deployed; one to Chuuk State Hospital Weno, Chuuk, FSM in February 1998; another to Majuro Hospital, Marjuro, Republic of the Marshall Islands in March 1998; Pohnpei State Hospital, Kolonia, Pohnpei, FSM; and the Ministry of Health, Koror, Republic of Palau in March 1998. The installation of these work stations occurred following the 6th Annual Meeting of the PBMA in Weno, Chuuk, February 1998. It was at that meeting that Rob

Whitton, Al Witsel and I demonstrated our concept of the system and provided those in attendance with some basic instruction with regards to its' use. Several physicians in the jurisdictions had their own personal computers and access to the Internet. The basic store-and-forward methodology was developed over several years and has been described previously[4].

The equipment provided each jurisdiction included: monitor, scanner, digital still camera, and video camera. Additionally, a digital otoscope and opthalmoscope were provided to three sites. More recently, a small capture device was evaluated and made available to jurisdictions that had binocular microscopy equipment. The original equipment provided Palau is contained in Table I. And a photograph of one of the original work stations is shown in Fig. 3. During March 2001, the equipment was replaced at the four original sites (Chuuk, Majuro, Palau, and Pohnpei). All of the jurisdictions had at least one telemedicine work station by June 2001.

Table I. **Palau's telemedicine equipment list (01/16/98)**

Palau	Item	Cost	PO Number	Status
Monitor	17" Mitsubishi	$929.50	10363	Backorder
CPU	PII223 ATX	$4,115.00	10363	Arrived
Modem	56K X2	included	10363	Arrived
Hard drive	4.5GB Seagate Wid	included	10363	Arrived
Sound card	64 AW E Value	included	10363	Arrived
Network card	None			On Hand
PCMCIA	5.25" Reader	included	10363	Arrived
Video card	MedRx	included	10363	Arrived
Camera	Olympus 600L	$1,202.00	10364-1	Arrived
Scanner		$989.00		
Printer	Epson Stylus 800	$385.00	10364	Arrived
Cable	IBM Bi-directional	included	10364	Arrived
Ink	5 pack	$122.50	10363	Arrived
Zip Drive	Iomega Zip	$135.00	10364	Arrived
Zip Disks	6 pack	$79.00	10364	Arrived
Office 97	MS Office Pro 97	$515.00	10364	Arrived
Photoshop		$509.00		
Tool Kit	Belkin 65 Piece	$57.00	10364	Arrived
Shipping	DHL 4 day	$500.00		Awaiting Shipment
Total		$9,538.00		

Figure 3. Basic telemedicine workstation

Results and Discussion

During the period of review there were fifteen active physician users from Palau. Table II lists the providers by name, specialty and number of cases consulted or referred. The number of patients referred by each practitioner is a little misleading in that some providers used other provider accounts. This was especially true for the surgeons. Those 15 providers consulted on 511 cases out of the 2,500 which is remarkable in that over 20% of the cases were referred from the smallest population base. With an approximate population of 20,000 the Republic of Palau is least populace when compared to the more than 500,000 people of the USAPIs (only 40% referred). There were 292 females (57%) and 219 males (43%) referred. The age range of cases was reflective of the population; 88 (17%) under 18 years of age, 233 (46%) between 18 and 50 years, and 190 (37%) over 50 years of age.

The distribution of cases by year is depicted in Figure 4. The fewest patients were referred in 2001. There is really no good explanation and although the terrorists attack on America on September 11, 2001 may have had some effect, it occurred at the end of the federal FY2001. The cost of travel and medical care for Palauans referred under the program is shown in Figure 5. The

Table II. **Providers from Palau**

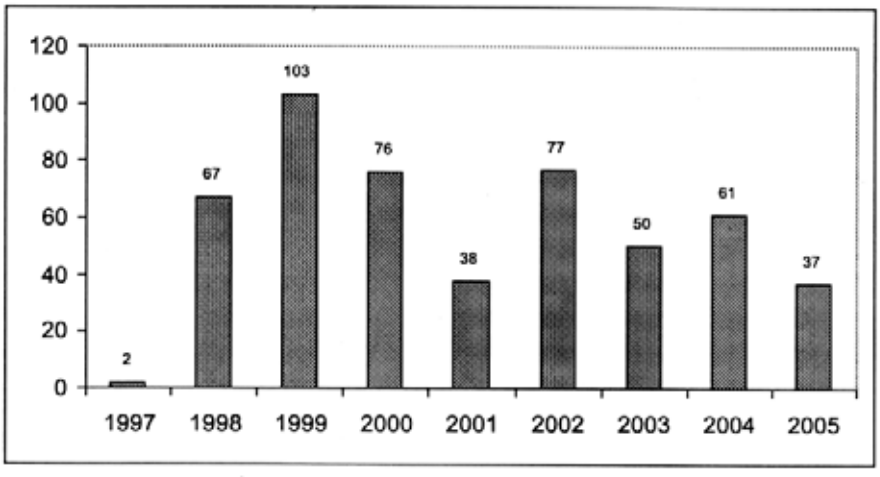
Provider	Cases	Specialty
Howard Bayagau	6	Obstetrics and Gynecology
Gregory Dever	22	Pediatrics
Bo Htoo	33	Orthopedic Surgery
Stevenson Kuartei	56	Family Practice
Robert Maddison	16	Internal Medicine
Joji Malani	1	Internal Medicine
Selerina Malsol	15	Obstetrics and Gynecology
Angela Marcil	4	Internal Medicine
Ngirachisau Mekoll	45	General Practice
Debbie Ngemaes-Maddison	15	Obstetrics and Gynecology
Ulai Otobed	15	Obstetrics and Gynecology
Emais Roberts	142	Surgery
Francisca Soaladaob	17	Surgery
Victor M. Yano	116	Family Practitice
Sung-il Yoon	1	Surgery

total amount for the 6 years (FY99-FY04) was in excess of 5.5 million dollars. For comparison, Figure 6 shows total expenditures for all jurisdictions. Certainly travel costs have gone up since the inception of the program. But the real increase has been in medical care costs. In an attempt to contain those costs, hospital beds (both general and intensive care unit) have been closed and where possible, medical and surgical treatment has been shifted from the in-hospital setting to the clinic. Day surgery, with less than 24-hour in-hospital stays have become the rule, rather than the exception. Utilization management techniques have been instituted and bed days (length of stay) have been markedly reduced.

The contributions of the physicians from the Republic of Palau to the PIHCP are numerous and certainly deserve special mention. Photographs (5), radiographs (6,7), and ultrasound images are attached to many of their consultations. Dr. Yano referred a newborn with congenital acute lympholbstic leukemia (ALL). Figure 7 shows the infant with protuberant abdomen. The "babygram" (whole body x-ray) demonstrates the marked hepatosplenomegaly. The infant arrived at TAMC with in a total peripheral white blood count of more than 1,000,000 cells/mm3! The baby survived induction chemotherapy and was put into remission, but sadly succumbed to overwhelming sepsis a few weeks later. Based on Palau's population and birthrate Dr. Dever calculated that expected occurrence of congenital ALL to be one case every 750 years! The Palau physicians attach more images to enhance their consultations than do those from any of the other jurisdictions. Another patient referred from Palau was an elderly man who had a rare carcinoma of the penis (Fig. 8). Most US trained physicians only read about such a lesion in the pathology text books. At my suggestion, mammograms were attached to the case histories of patients with suspected breast cancer as early as November 1999 (Fig. 9) and the surgeons from Palau lead the way.

Despite the lack of a radiologist, physicians from Palau have utilized the technology primarily promulgated by Dr. Yano well in supplementing the clinical assessments with selected computerized tomographic (CT) images, again sometimes with dramatic results as seen in Figure 10. This CT demonstrates a very large brain tumor. A few years ago we evaluated the utility of a small capture device which fit into a binocular microscope such as is used in culdoscopy, ophthalmoscopy, and direct microscopy (8). Cervical photographs, cervical fluid smears, and peripheral blood smears were attached to appropriate cases and forwarded to the PIHCP (Figs. 11, 12, and 13). Dr. Yano has for several years attached ECHOcardiographic videoclips to enhance the consultations of patiens with heart disease, especially, recurrent and chronic rheumatic heart disease. The diligence required to provide useful images cannot be overstated. These are truly remarkable clips.

Figure 4. Palau Cases by Year



(Expenditures include Hospital and Travel Costs)

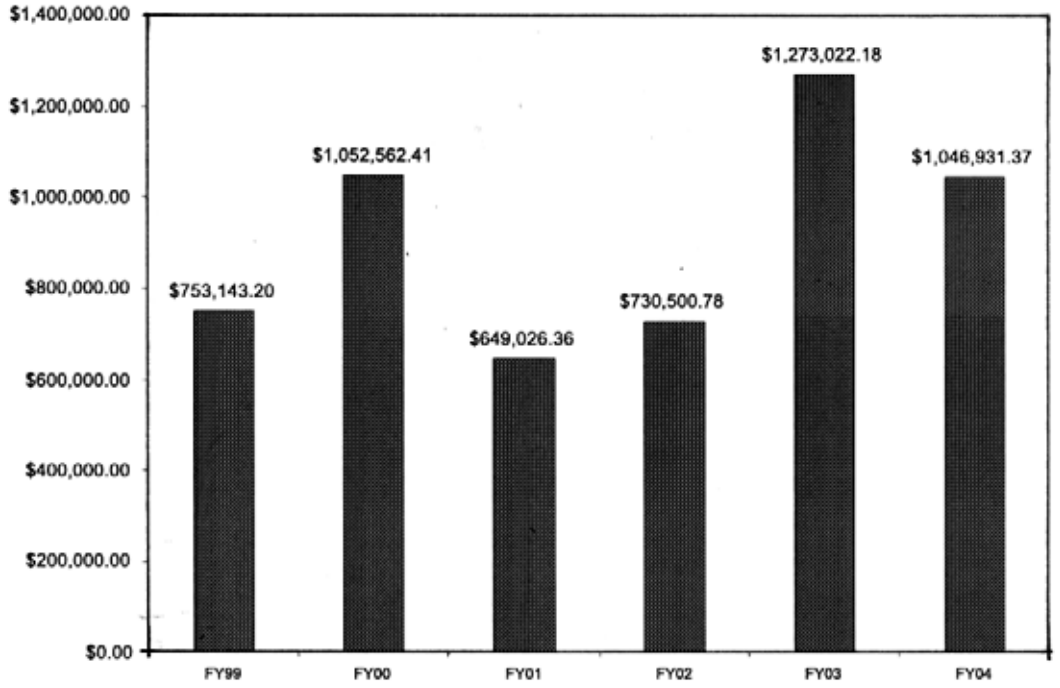


Figure 6. **Total PIHCP Expenditures: FY1999 to FY204**
(Expenditures include Hospital and Travel Costs)

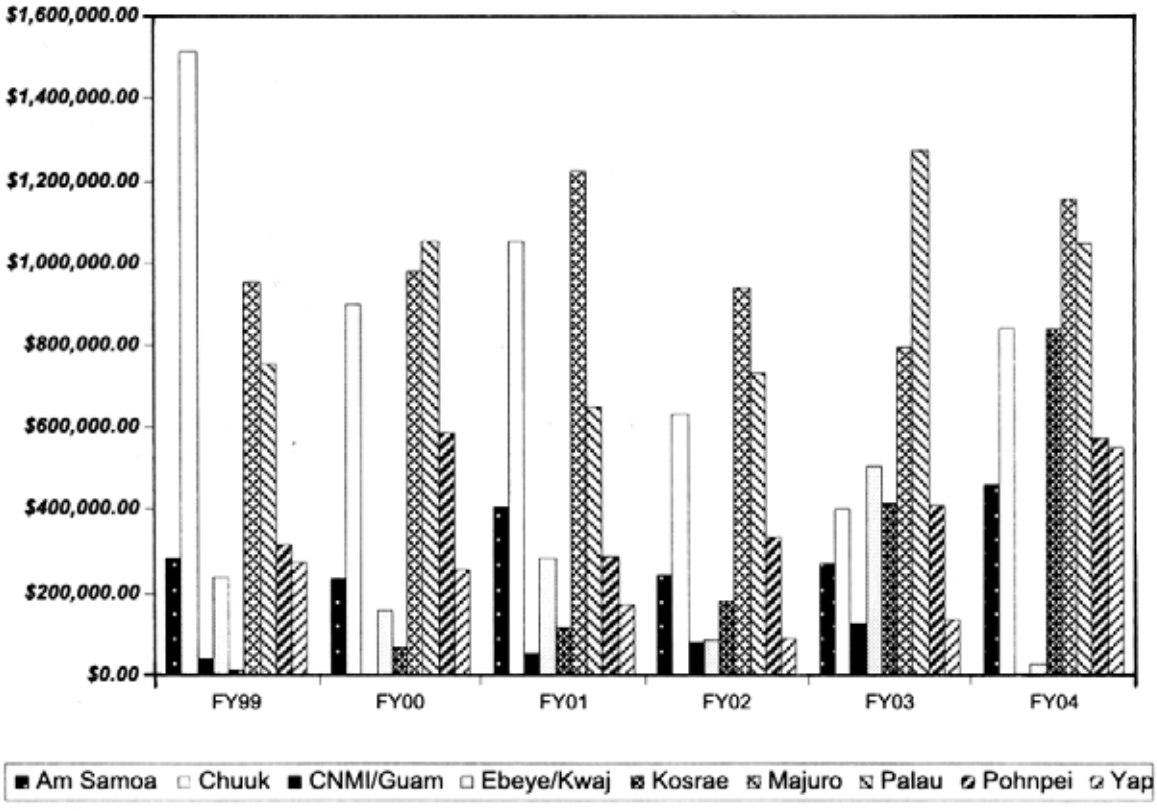


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Figure 7. **Baby with congenital leukemia**

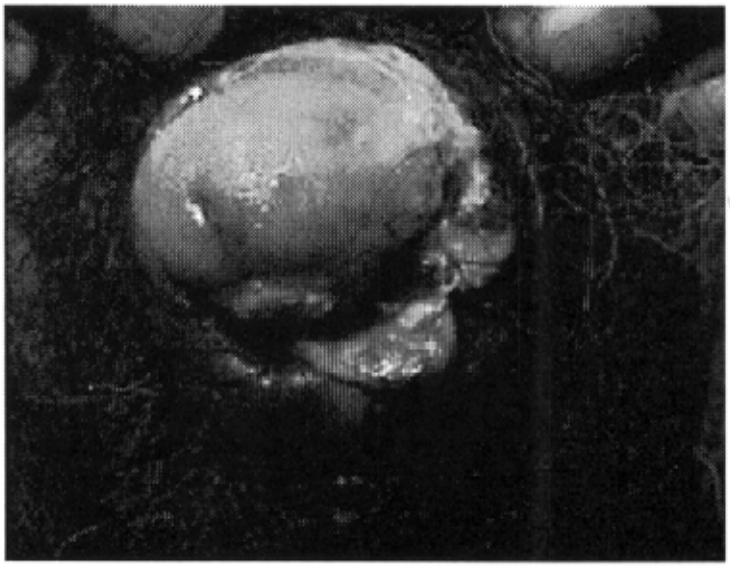

Figure 8. **Carcinoma of penis in an elderly man**

The 511 cases consulted/referred from Palau to the PIHCP are categorized and tabulated in Table III. Cancer accounts for over a third of the patients referred (9). The most common cancers include; cervical, lung, prostrate, liver, and breast tumors (10). Less commonly, gastrointestinal, genitourinary, soft tissue, bone, and hematologic malignancies such as lymphomas and leukemias. Renal stones are very common and a number of these patients come to TAMC for lithotripsy or direct surgical removal of sometimes massive staghorn calculi. Thyroid disease to include goiter as well as carcinoma of the thyroid are also common. Heart involvement as noted is most often, secondary to rheumatic fever with recurrent rheumatic heart disease. Skin diseases both infectious (tuberculosis, leprbsy) and non-infections (vasculitis) are common place. Pulmonary tuberculosis continues to be the scourge of the developing world. Fractures which resulted in mal-unions or non-unions are often referred for definitive care (11). Likewise, bone and muscle tumors constitute surgical referrals (11, 12). Recurrent otitis media with

Table III. **Classifications of cases consulted/referred**

Organ System/Condition	Number	Percent
Cancer	179	35%
GU, renal	73	14%
Endocrine/Thyroid	44	9%
Heart	41	8%
Skin	36	7%
Neuropsychiatric	20	4%
Respiratory	18	3%
Orthopedic	16	3%
Gastrointestinal	15	3%
ENT	11	2%
Other	58	12%
Total	511	100%

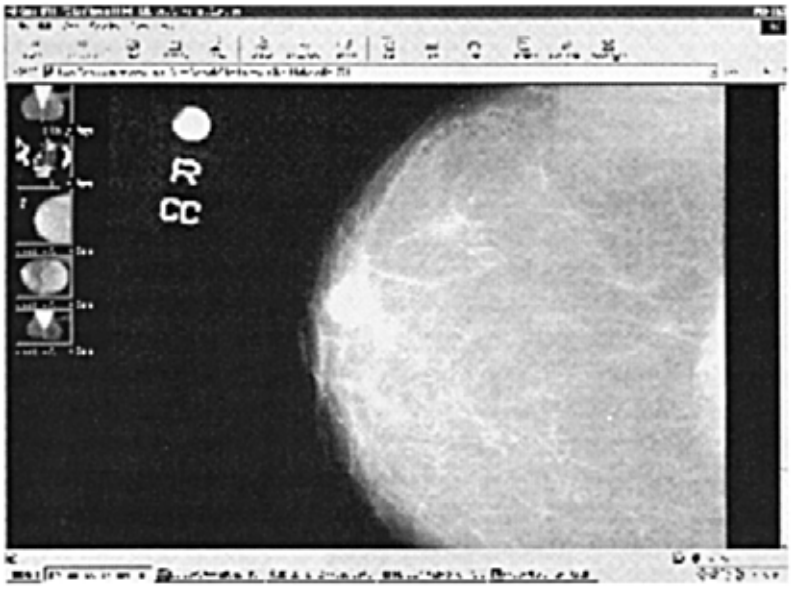

Figure 9. **Mammogram**

chronic tymphanic membrane perforation (Fig. 15) which results in cholesteatoma formation, cleft lip/palate, as well as head and neck cancers are of special interest to the otolaryngologists/ head and neck surgeons.

Virtually all of the training programs at TAMC have benefited from the patients referred from the USAPIs, especially those from the Republic of Palau. Many patients referred for surgery are first evaluated and worked up by residents in the internal medicine or pediatircs. Post operatively the patients are often cared for jointly by several services, thus benefiting a number of training programs. In years past, occasional obstetrical patients were admitted to the program, but current bed day constraints have precluded long term hospitalization for high risk pregnancies where the possibility of two patients, one a very sick premature baby is a real possibility. Now women with gynecologic malignancies make up the bulk of cases accepted to obstetrics and gynecology. These patients have provided our residents and staff with a wealth of experience.

Conclusion

For years there has been a close relationship between the Republic of Palau and TAMC. Their relationship has been strengthened by the development of the PIHCP. The contributions of the physician leadership from Palau have been noteworthy, not only professionally been noteworthy, not only professionally but also the persistent emphaisis on new and evolving technologies within the constraints of the developing world. This in turn has provided the impetus to develop and improve the PIHCP. Palauan physicians refer more patients per capita than are referred from any other jurisdictions. The patients are more completely evaluated, have more attached imagery, more complete laboratory studies and as such are more easily accepted into the program. Despite the small population base, more Palauans are accepted into the PIHCP and per capita more money is spent in their care. I look forward to a long and continued relationship.

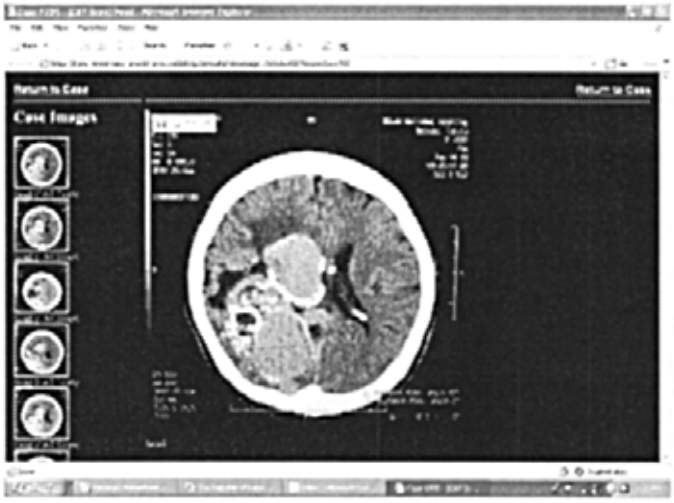

Figure 10. **CT image of a brain tumor**

Figure 11. **Culposcopic capture of an inflamed cervix**

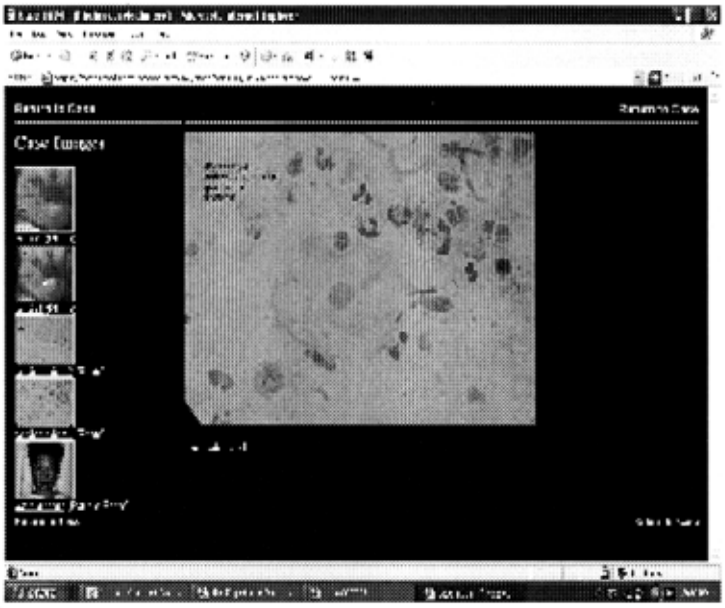

Figure 12. **Stained cervical smear**

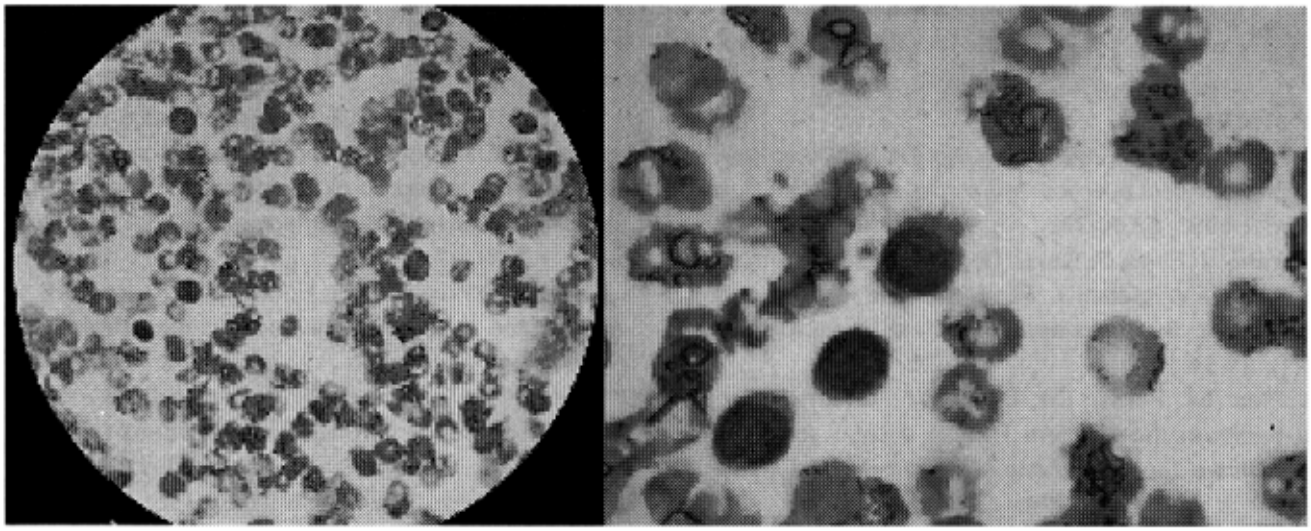

Figure 13. **Peripheral blood smear from a patient with hairy cell leukemia**

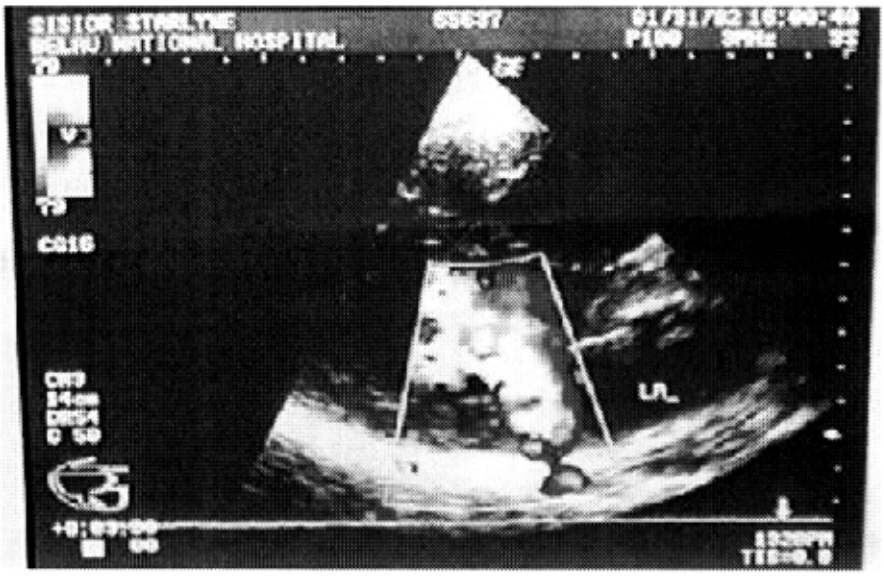

Figure 14. **Echocardiogram**

Figure 15. **Otoscopic view of perforated tympanic membrane**

References

1. Delaplain CB, Lindborg CE, Norton SA, Hastings JE. Tripler pioneers telemedicine across the Pacific. *Hawaii Med J,* 1993; 52:38-339.

2. Yano V, Finau 5, Dever G, Person DA, Samisohi J, Baravilal'a W, Malani J. The BPMA and telemedicine in the Pacific: the first steps. *Pacific Health Dialog,* 1997; 4(1): 81-84.

3. Flear JA, Person DA, Dever GJ. Communications in health in the Western Pacific: a case study. *Int J Healthcare Technology and Management,* 2000; 2:246-254.

4. Person DA. Pacific Island Health Care Project: early experiences with a web-based consultation and referral network. *Pacific Health Dialog,* 2000; 7(2): 29-35.

5. Person DA, Hedson JS, Gunawardane KJ. Telemedicine success in the United States Associated Pacific Islands (USAPI): two illustrative cases. *Telemed J and e-Health,* 2003; 9(1): 95-101.

6. Ruess L, Uyehara CRT, Shields KC, Cho KH, O'Connor SC, Whitto RK, Person DA. Digitizing pediatric chest radiographs: comparison of low-cost, commercial off-the-shelf technologies. *Pediatr Radiol,* 2001; 31:841-847.

7. Park JM, Ruess L, O'Connor SC, Hussain F, Oshiro DY, Person DA. Internet consultations from a remote Pacific Island: impact of digitized radiologic images on referral decisions. *J Digit Imaging,* 2004; 17(4): 253-257.

8. Belnap CP, Freeman JH, Hudson DA, Person DA. A versatile and economical method of image capture for telepathology. *J Telemed Telcare,* 2002; 8:117-120.

9. Person DA. The Pacific Island Health Care Project: easing the cancer bůrden in the United States Associated Pacific Islands. *Pacific Health Dialog,* 2004; 11(2):243-247.

10. Wong V, Taoka S, Kuartei S, Demei Y, Soaladaob F. Cancer in the Republic of Palau (Belau), *Pacific Health Dialog*, 2004; 11(2):64-69.

11. Hensel KS, Person DA, Schaefer RA, Burkhalter WE. An internet-based referral/consultation system for the U.S. Associated Pacific Islands: its contribution to orthopedic graduate medical education at Tripler Army Medical Center. *Military Med*, 2005; 176(3)L 214-218.

12. Kavolis J, Pallis M, Burkhalter W, Person D. Massive osteosarcoma of the upper extremity. *Surgical Rounds,* 2002; June :296-301.

If you do anything just for money you don't succeed.
(Barry Hearn)