Articles

Operation Desert Shield/Storm Neurosurgery— 2nd General Hospital—Place, Process-Lessons Learned

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The Persian Gulf conflict placed a special need for neurosurgical beds to be in-place within the European Theatre. The 2nd General Hospital, Landstuhl Army Regional Medical Center, the designated EUCOM neurosurgical-spinal cord injury center, successfully modified its configuration to comply with the needs of the tactical mission of those assigned to Southwest Asia. Of those patients aeromedically evacuated to the 2nd General Hospital, 653 were admitted to the Neurosurgical Service. A short discussion of the variety of patient problems and diagnoses is presented.

The headlines announcing the invasion of Kuwait were as much of a surprise to those of us stationed with the 2nd General Hospital as they were to everybody else. We were as aware of the multitude of problems in the fertile valleys of the Tigris and Euphrates as the remainder of the general public. Many had friends who had participated in the military mission(s) to Saudi Arabia, a few had been involved directly or indirectly in the attempted rescue of the Teheran (US Embassy) hostages nearly a dozen years before. Memory of the casualties of the Iraqi Exocet rocket attack upon the *USS Stark* (May 1987) and the mine explosion that severely damaged the *USS Samuel Adams* (April 1988) lingered with many. The cease-fire agreed between Iran and Iraq, bringing their 9-year war to a close, certainly had not stopped the hostilities in the Caucasus where the Kurds, Turks and Azerbaijani continued their centuries-old conflicts. Peace had prospered in central Europe for over 40 years. Armed conflict was the last thing anyone had in mind after the unimaginable had occurred in Poland, Berlin, and Czechoslovakia and after the two Germany's had become reunited.

The initial speculation about Uncle Sam's response to the invasion was soon a mute point. President Bush, in no uncertain terms, stated the position of the United States with regards to the invasion of Kuwait and the threat imposed upon Saudi Arabia. The rhetoric was rapidly enforced by deployment of the 82nd Airborne Division followed quickly by the remainder of XVIII Airborne Corps. The initial compliment of about 800 arrived August 10, with nearly 20,000 XVIII Airborne Corps Troops and 2000 tracked/wheeled vehicles on the ground in Saudi Arabia before the 20th.

The 7th Medical Command, composed of 11 forward deployed fixed medical facilities, rapidly dusted off and rewrote mobilization/deployment schemes for scenarios previously thought to be "pie in the sky." The 2nd General Hospital, Landstuhl Army Regional Medical Center, near Kaiserslautern, Germany, is the largest and most specialized of these forward deployed fixed medical facilities. It is also the designated neurosurgical/spinal cord injury center within the European theatre. In accordance with guidance from 7th MEDCOM, the administration and staff of the 2nd General Hospital devised a graduated action plan for expansion of the hospital to meet the needs of any evacuation plan that might become a reality in the face of overt hostilities within the Persian Gulf area.

Although the 2nd General Hospital functioned on a day-to-day basis in just like any other comparable 250-bed hospital, there were some major fundamental differences to our civilian counterparts. Approximately 40% of the useable footage within the hospital was utilized by "clinic" or office space and an additional 10% was utilized as lounge, day rooms, break rooms, and designated smoking rooms for visitors, patients and staff. The initial steps in expansion were to more efficiently utilize the remaining 50% already used for in-patient care. The graduated responses in expansion were to be tied to bed occupancy. Since the Landstuhl Hospital routinely cared for 180 to 195 inpatients, it was thought that absorption of a 10% to 20% increase in daily bed-occupancy would not be overly stressful. However, it became quickly evident that these incremental increases in occupancy would maximally stress and soon over-extend an already stretched enlisted and Nurse Corps. The staffing "bill" was forwarded to headquarters with the hope that, should hostilities occur, it would be filled before the 2nd General Hospital was inundated with casualties.

The mix of casualties to be expected from desert warfare was reasonably predictable from the Israeli-Arab conflicts of the past 25 years, the 9-year Iraqi-Iranian war and from historical review of the North African campaigns of World War II. The rate and frequency of casualties predicted by the 309 diagnostic categories ac-

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cumulated from WWII, Korea and Vietnam were to be of value but skewed away from the causalities anticipated from tank warfare supported by massed infantry in the desert environment. Utilizing these "knowns," a reasonable amount of intuition and a modicum of speculation the neurosurgical service of the 2nd General Hospital prepared for the worst. The planning sessions began in August, and after a number of "final plans" that were subsequently revised, the end-product was published in its final form in October 1990. By that time we also knew the tasking that was imposed upon the 2nd General Hospital staff for deployment to operation Desert Shield in support of VII Corps. Our final plan, as approved by headquarters, 7th MEDCOM, envisioned six neurological surgeons, a 40-bed neurosurgical ward for postoperative and non-ICU (intensive care unit) patients which would be coupled with a second 40-bed neurosurgical ward for less seriously ill patients. A third, 42-bed neurosurgical ward was specially designated for spinal cord and peripheral nerve injured patients. This ward was fully complimented with Stryker frames, Halo fixation devices, suction, oxygen and ventilators. The fourth 38-bed neurosurgical ward was specifically designated as convalescent/self care with a minimum of staffing. The staffing requirements for the 122 acute neurosurgical- and spinal-cord-injury-beds severely taxed the nursing service.

Based on the assumption that the neurosurgeon would, by necessity, be in the operating room, the intensive care units, or asleep we enlisted the services of our medical neurology colleagues to be the ward physicians for each of the acute wards. We spoke a common language, were equally familiar with the end organ and by nature of our clinical association confident in each others appraisal of clinical situations. In addition to the neurosurgical beds already mentioned, the 23-bed ICU intrinsic to the 2nd General Hospital was fully equipped with the latest physiological monitoring equipment and staffed by dedicated intensivists. Intracranial pressure monitoring has been practiced at the 2nd General Hospital for many years and was augmented by fully up-grading the Camino apparatus to the latest available equipment. Knowing that a 23-bed ICU would be totally inadequate, an additional 30 ICU beds were constructed by redesign and special utilization of the Ob/Gyn Clinic, Urology Clinic and the Renal Dialysis Unit. These ICU beds were to be staffed by a combination of traumatologists, general surgeons and internists, thus creating 53 ICU beds with dedicated specialists as their round-the-clock staff. The Landstuhl Army Regional Medical Center, the designated major evacuation destination for neurosurgical injuries occurring during operation desert shield was looking good—on paper.

We were not the only ones who were planing and accessing their equipment and personnel. We received a call the last week of September from our neurosurgical colleagues attached to the 28th CSH (44th Med Bde), deployed with VII Corps, indicating that their deployed equipment and consumables needed a transfusion. Personnel from this facility, with the assistance of USAMMCE, Pirmasens, Germany, forwarded two shipments of surgical instruments and consumables sufficient to conduct 200 neurosurgical procedures, to the 28th CSH (Combat). The second shipment was received in Saudi Arabia October 21.

One of the three neurosurgeons assigned to the 2nd General Hospital was selected to be Chief, Neurosurgery, 12th Evac Hospital. Doctor Christopher Smythies spent the month of November and early December preparing for and deploying to Saudi Arabia with the evacuation hospital organic to VII Corps. Along with Dr. Smythies a number of other surgeons (thoracic, general, orthopedic), anesthesiologists, primary physicians and operating room staff joined the deployment to the Persian Gulf. The 2nd General Hospital was really beginning to feel the pinch.

As will happen in any major industrial setting, with large populations of personnel on the move, accidents predictably will and did occur, especially when heavy equipment is involved. These same populations can be expected to develop a variety of illnesses and exacerbations of old illnesses and injuries. In the special case of many rapidly mobilized reserve personnel a variety of acute and subacute physical disabilities, which would otherwise have precluded deployment, went undetected and unreported for a variety of reasons. As October 1990 ended, there were in excess of 145,000 troops deployed to operation Desert Shield, about 110,000 of whom were Army with over 35,000 tracked and wheeled vehicles on the ground in Saudi Arabia. By this same date, the 2nd General Hospital had received 390 air evacuees from the Persian Gulf area, 72 of which had been admitted to the Neurosurgery Service. We had, by necessity, made a graded "ratchet" adjustment in our bed availability by converting all lounges, break and smoking rooms into patient bed areas. We had not received any augmentation personnel and all essential patient care nurses and corpsmen were working 12- to 14-hour days, and, on many nursing units, for 10 to 12 days between days off. The stress of the situation was beginning to be noticeable.

As the 12th Evacuation Hospital deployed December 12, we were beginning to receive augmentees from the 328th General Hospital, Salt Lake City, Utah and the 45th Station Hospital, Portland, Oregon. The availability of increased numbers of nurses and corps personnel lifted the spirits of all in the pre-holiday time frame. By Christmas there were in excess of 220,000 troops on the ground in Saudi Arabia and the staff at the 2nd General Hospital had nearly doubled. We received another infusion Christmas Eve with the arrival of the 315th MASH, from Chattanooga, Tenn.

During the months of November and December the 2nd General Hospital received 458 aeromedical evacuees from Saudi Arabia, of which 116 were admitted to the Neurosurgery Service. Landstuhl Army Regional Medical Center was now a functional 500+ bed tertiary care facility in all respects. At this point in time there were 18 neurosurgeons (Navy and Army) in the Persian Gulf, aero-evacing Southwest Asia theatre neurosurgical patients to the two staff neurosurgeons assigned at Landstuhl.

Anticipating President Bush's rapidly approaching January 15 deadline, the staff was directed to remove all personal belongings from the numerous offices throughout the hospital. This was no mean task for those of us with 30 years of journals and personal medical libraries in our offices. These tasks were completed and additional areas were converted to patient care areas by January, 10-12. Desert Shield evacuees out-numbered, more than 2:1, the remainder of the approximately 600 patients who were hospitalized at the 2nd General Hospital in early and mid-January 1991. All clinic office activity basically ceased since we no longer had clinics through which to see patients. Arrangements were finalized with neurosurgical colleagues in several universities and the *Bundeswehr-Zentralkrankenhaus*, Koblenz to receive patients in transfer, should the necessity arise. Those outpatients whom we were able to see, for the most part, had complaints related to their backs and necks. They were not medical/surgical emergencies, rather, we were answering questions concerning deployability. We were admitting and operating on limited numbers of active duty soldiers. Concurrently, we were requesting nonactive duty patients to await the end of the war if possible (an uncertain request at best); if not possible suggesting that they go for treatment in CONUS (availability equally uncertain). Emergencies and acute neurosurgical conditions were operated by either Dr. Ross Moquin or myself, when they could be scheduled around our mission to care for ever-increasing evacuees from Operation Desert Shield.

As we were reporting for the alert called during the early morning hours of Jan 17, 1991 (the start of the air war), another contingent of augmentees were arriving. Elements of the 44th General Hospital, Madison, Wis. and the 94th General Hospital, Dallas, Fort Worth, Tex. followed by the 56th General Hospital, Fort Eustis, Va. were reporting for duty. They were much needed reinforcements who made it possible for the 2nd General Hospital to be appropriately staffed as a 1,000-bed general hospital. The army of ants went to work that Thursday morning and six days later there were nearly 1,000 occupiable beds and 100s of miles of newly installed conduit, wire, pipe and cable supporting those beds. The transformation was as striking as that which we had observed in Berlin with destruction of the wall and the rapid progression toward a unified Germany.

The air war was underway and the 2nd General Hospital was standing ready to accomplish its mission as tertiary level evacuation medical facility in Europe. The neurosurgery service was augmented on Jan 17, 1991, by arrival of Dr. Larry Teuber. Dr. Teuber was completing the last six months of his postgraduate training as a neurological surgeon, Medical College of Wisconsin, when he was activated and attached to the 44th General Hospital as neurological surgeon. Prior military duty and training as a helicopter pilot would serve him well as he returned to active duty. Dr. Marco Eugenio joined us on Jan 28, 1991. Dr. Eugenio had been awaiting approval of his request to join the Army reserve for over a year. He had already enjoyed his 64th birthday and was principally interested in providing expertise as a senior volunteer to the Neurosurgery Service, Brooke Army Medical Center, from his practice in Corpus Christi, Tex. Approval of his various waivers were finalized on Dec 6, 1990, just in time for activation. Since Dr. Eugenio had never worn a uniform before, it was necessary for him to spend time in basic instructions before his deployment to Europe with the 94th General Hospital. The neurosurgical expertise deployed to the Landstuhl Army Regional Medical Center in the persons of Drs. Eugenio and Teuber was greatly needed and welcomed with open arms. The two other neurosurgeons requested and promised never materialized.

By necessity, both inpatient and outpatient care, other than for evacuees from southwest Asia, was discontinued. As the air war began, we transferred inpatients to other hospitals if they could not be cared for at home. Support from other MEDDACs in Europe and the *Bundeswehr-Zentralkrankenhaus*, Koblenz in accepting inpatient transfers was instrumental in the 2nd General Hospital's preparedness to preform its mission.

We were ready. The world waited. The remainder of our forces deployed to Saudi Arabia, by mid-February. There were in excess of 330,000 troops preparing to confront the Iraqis. The evacuation of sick, injured and unfit troops continued throughout the buildup; the 2nd General Hospital received 469 evacuees in January 1991 and prior to the start of the ground war (24 Feb), 390 additional patients arrived. Of these 850 aeromedical evacuees, 202 were admitted to the neurosurgery service.

We followed a self-imposed evacuation policy that required return to duty within 14 days of arrival from Desert Shield/Storm. If this was not reasonably expected upon admission, aeromedical evacuation to CONUS was initiated for CONUS-based service members. If the individual was European-based, they were returned to their unit, but not Southwest Asia. We could ill afford to fill our beds with ambulatory and/or noncritical postoperative patients as we awaited battle casualties. Few of those patients evacuated to the neurosurgery service could be sent back to Southwest Asia, and even fewer of the patients

actively sought their return to Desert Storm. We were in telephone and message contact with our contemporaries in the desert and thus were able to keep a tally of the numbers of neurological surgeons and their locations. It became evident that the four neurological surgeons assigned to Landstuhl were receiving patients from 47 neurological surgeons deployed to the Persian Gulf. A lopsided but so far a manageable arrangement.

Suddenly, Desert Storm was over for the front line troops. The cease fire initiated on February 28, ended a miraculous 100-hour war. Redeployment started in March 1 for those deployed to Southwest Asia. As the troops in Southwest Asia and our augmentees began to plan their return to prewar status the wounded arrived. There was a continuous evacuation of injured, ill and disabled. The months of March and April brought 650 and 351 evacuees respectively, 226 of which were admitted to the neurosurgery service. We considered Operation Desert Shield/Storm completed from a Neurosurgical standpoint by the end of May 1991; VII Corps and our friends and colleagues had returned, the augmentees from CONUS had returned to their former lives and the number and frequency of aeromedical evacuees from Southwest Asia had nearly stopped. In the end, 3,283 patients were admitted to the 2nd General Hospital from Operation Desert Shield/Storm and of those 653 were admitted to neurosurgery.

The variety of diagnoses for those admitted to the Landstuhl Neurosurgery Service ranged from postoperative third ventricular colloid cysts to postoperative cerebral aneurysms; from paraplegia secondary to spinal plasmacytoma to complex spine fractures requiring C-D instrumentation; from retained intracranial metallic fragments to posttraumatic cerebral concussion and contusion; from spastic quadraparesis secondary to chronic cervical myelopathy to the entire gamont of neck and back pains; from Jefferson and odontoid fractures received in halo apparatus to ventilator dependent cervical fractures with associated poly-system injuries; from tardy ulnar palsy to subacute peroneal palsy; a potpourri of neurosurgical conditions and diagnoses as would be expected from a population base of nearly half a million souls.

The discussion of the intracranial and major spine diseases, injuries and wounds are the subject of another paper by my colleague LCDR Ross Moquin, staff neurological surgeon, 2nd General Hospital. I would like to discuss what we found to be quite surprising and at the same time distressing for nearly a battalion-level segment of service members.

Of the 653 patients aeromedically evacuated from Desert Shield/Storm to the 2nd General Hospital, 108 had major intracranial, spine or peripheral nerve injuries, wounds or diseases. The remainder, 541 soldiers, sailors, airman, marines, and coast guard personnel, were aeromedically evacuated because of inability to serve due to acquired or pre-existing disorders of nonacute or subacute nature. Included in this group are a few patients with multiple sclerosis (newly diagnosed) and similar chronic disorders that preexisted in deployed service members who were swept up in the widely cast net at the time of deployment/activation of units. An example is a young soldier deployed with his unit who had undergone an extensive surgical procedure for a glomus jugulari tumor, and as a result had residual "wipe out" of multiple lower cranial nerves. He had his nasogastric feeding tube removed only shortly prior to deployment. His ability to drink (sips only) and eat (MREs were the only food available) were sufficiently limited that by the time he was aeromedically evacuated to the 2nd General Hospital he was reminiscent of concentration camp evacuees of 45 years ago. He insisted that he was "fit to fight" and requested immediate return to his unit in Saudi Arabia.

By far the largest group of evacuees were for chronic or recently acquired disorders of the neck and back. The next largest group were those evaluated for cephalgia and potential seizure disorder. We were able to identify 412 evacuees whom we evaluated for "sore necks and backs;" 97 "sore necks" and 315 "sore backs."

The analysis of admission rates of soldiers during World War II for "HNP" revealed an admission rate of 0.5 per thousand, with a total of about 14,000 individuals so diagnosed. This resulted eventually in veterans administration compensation to about 16,000 veterans for "HNP" incurred or aggravated by military service.[1] There seems to be no similar data available following the Korean War or Vietnam. Certainly the data base proposed by the 309 diagnosis utilized in DEPMED planning did not foresee the magnitude of evacuees for neck and back problems. If we assume the total forces strength to have been 500,000, and we utilize the 0.5/1000 incidence, we could then expect approximately 250 cases of "HNP." This conflict certainly was not of the same sustained nature and I am certain that other factors also skew these figures. The total number of troops (excluding those admitted to the 2nd General Hospital) admitted to other medical facilities OCONUS, as well as CONUS, with neck and back disorders is not known to me.

Since the beginning of time, warriors have dealt with the problems of back disorders; King David complained of back pain in Psalm 129:3, and Hippocrates is said to have described a variety of causes for curvature of the spine and that certain "Movements of the body . . . everybody begins to endure pain, it will be relieved by rest." Students of Shakespeare will recall "Load o' gravel I' th' back, sciatica" and "Thou cold sciatica, cripple our senator." In the nonmilitary world back pain seems second only to upper respiratory infections in causing lost man-hours from the work place and is said to cost US industry an estimated 25 to 30 billion dollars yearly in lost wages and compensation. In fact, social security sta-

tistics indicate that low back pain is a greater cause of disability among those of working age than the aggregate of AIDS, cancer and stroke.[2] The National Center for Health Statistics suggested in a 1984 study that approximately 8.6 million Americans had impairment caused by spinal disorder.[3] A 1988 study, suggested that 75% of adults in the United States will have significant low back pain some time in their lives (4) and another suggests that about 10% will have sciatica.[4,5] Most low back pain sufferers state what the literature seems to support; hard physical labor increases the likelihood of low back pain.[6-8]

Let us review the diagnostic classifications of those evacuees whom we cared for in the 2nd General Hospital:

I. "SORE NECKS" 97

(1) Prior cervical disc surgery—unable to function—evacuated to CONUS . . 7

(2) Cervical disc surgery preformed at the 2nd General Hospital 4

(3) Clinically documented cervical disc syndromes—evacuated to CONUS . . 18

(4) Cervical spondylosis with radicular and/or long tract signs — evacuated to CONUS 17

(5) Neck/shoulder/arm pains without neurologic signs or symptoms — assumed to be muscular in origin — evacuated to CONUS 51

II. "SORE BACKS" 315

(1) Prior lumbar disc surgery — unable to function — evacuated to CONUS . . 23

(2) Lumbar disc surgery preformed at the 2nd General Hospital 16

A. European-based service members 11

a. One (1) Returned to Southwest Asia postop.

B. CONUS-based service members 5

a. One (1) returned to Southwest Asia postoperatively.

(3) Spondylolysis and spondylolisthesis — no prior history of surgery or awareness of structural abnormality — evacuated to CONUS 21

(4) Clinical signs and symptoms of nerve root compression syndromes — CONUS-based service members — evacuated to CONUS 51

(5) Back disorders without signs or symptoms of nerve root compression syndromes — European-based service members — returned to unit but not to Southwest Asia 41

(6) Back disorders without signs or symptoms of nerve root compression syndromes — CONUS-based service members — evacuated to CONUS . . . 163

The rigorous physical training that is routinely performed by military members no doubt has direct influence upon a portion of these figures. Another portion would have been identified and no doubt screened out in a less rapid deployment scenario. However, the need for rapid deployment and activation of large numbers of soldiers are not phenomena that are responsive to medical screening.

There would seem to be an excellent opportunity available to the Department of Defense to critically evaluate, as was done after WW II, those service members who were admitted to medical treatment facilities with disorders of the "back" as a consequence of participation in and support of the Persian Gulf conflict.

"Back" pain is not subjectively verifiable, quite unlike the presence or absence of a specific anatomic or pathologic lesion. We usually learn of a soldier's back pain as matter of history or on occasion if behavior "tells" us that painful suffering is occurring. The verbal report of pain is an interesting social communication but does not always relate to a specific injury or broken part of the body. Self-reporting of "back" pain is not necessarily an accurate measure of demand or need for health care, nor is there necessarily a relationship between the complaint of "back" pain and the existence of a disability. The demands of a soldier's life and the need to be prepared for the mission indeed cloud, if not obscure, the requirement for health care intervention to return the individual to his or her customary employment.

There would also seem to be an excellent opportunity for the Department of Defense to initiate a well-controlled systematic evaluation of methods to isokinetically screen and test as well as rehabilitate service members with known or as yet unidentified disorders of the "back."[2] I believe it would be in the best interest of our employer, as well as the individual soldier, to identify potential injury before it occurs and to isolate certain repetitive activities that can be identified as conducive of, or a direct cause of "back" disorders.

Commercial equipment quite capable of these tasks has been utilized by private industry for nearly a decade. These computer-enhanced passive systems have been proven clinically dependable in non-subjective repetitively reproducing and documenting an individuals muscular capabilities in lifting, carrying and reaching, as well as screening for functional deficits that may increase risk of sustaining a "back" injury. The ability to predocument potential for injury allows for directed physical training and/or elimination of the tasks with high risk when possible. These evaluations, if used at time of entry and periodically throughout a military career, could provide a powerful asset in reducing lost man-hours and long-term compensable injuries. Passive computer-enhanced isokenitic equipment also provides for diagnostically directed rehabilitation and prevention programs which can be transferred with the service member and are not unique to any particular site, clinic or medical treatment facility.

The opportunity to learn from our experience is available. The need would appear to be reasonably documented. Time would seem to be of the essence, the "trail" only becomes "colder" the longer removed from the event.

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