ARMED FORCES INSTITUTE OF PATHOLOGY
Office of the Armed Forces Medical Examiner
1413 Research Blvd., Bldg. 102
Rockville, MD 20850
301-319-0000

FINAL AUTOPSY EXAMINATION REPORT

Name: BTB Marush, Muhammad Fahdil Khamat
SSAN: (b)(6)
Date of Birth (b)(6) 1968
Date of Deat (b)(6) 2008
Date and time of Autopsy: 10 DEC 2008 9:00 AM
Date of Report: 06 FEB 2009

Autopsy No. (b)(6)
AFIP No. (b)(6)
Rank: CIV
Place of Death: Balad, Iraq
Place of Autopsy: Port Mortuary
Dover AFB, Dover DE

Circumstances of Death: Iraqi detainee with history of remote penetrating head injury found unresponsive

Authorization for Autopsy: Office of the Armed Forces Medical Examiner, IAW 10 USC 1471

Identification: Positive identification by Fingerprint

CAUSE OF DEATH: Complications of penetrating head injury

MANNER OF DEATH: Undetermined

EXTERNAL EXAMINATION

The body is that of a well-developed, well-nourished male that weighs 139 pounds, is 69 inches in length and appears compatible with the reported age of 40 years. The body is cold after refrigeration. Rigor is present to an equal degree in all extremities. Lividity is present and fixed on the posterior surface of the body, except in areas exposed to pressure. The head shows evidence of medical therapy to be further described below. The scalp hair is black and shaved. Facial hair consists of a black mustache and beard. The irides are brown. The corneae are clear. The conjunctivae are unremarkable. The sclerae are white. The external auditory canals, external nares and oral cavity are free of foreign material and abnormal secretions. The nasal skeleton and maxilla are palpably intact. The lips are without evident injury. There are multiple remotely missing maxillary and mandibular teeth. The remaining teeth are natural and in fair condition. Examination of the neck reveals no evidence of injury. The chest is unremarkable. No evidence of injury of the ribs or the sternum is evident externally. The abdomen is flat. A healed 7 inch scar is present on the medial surface of the left upper arm and 2 ¼ inch scar is present on the lateral surface. The external genitalia are those of a normal adult circumcised male. The posterior torso and anus are without note. The extremities show evidence of injury to be further described below. The fingernails are intact. (b)(6) tattoo (b)(6)
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CLOTHING AND PERSONAL EFFECTS

- The body is received nude for examination.

MEDICAL INTERVENTION

- A gauze bandage is present over the head
- An 11 ½ inch stapled incision extends across the biparietal and frontal regions of the scalp
- A 2 ½ inch stapled incision extends posteriorly from the biparietal incision to the right parietal region
- A 2 inch stapled incision extends posteriorly from the biparietal incision to the left parietal region
- Three drains exit the scalp in the occipital vertex region
- Internal examination shows a bilateral craniectomy with removal of the majority of the biparietal regions of the calvarium
- Sutured therapeutic needle puncture sites are present in the right subclavian region and the right inguinal region

RADIOGRAPHS

A complete set of postmortem radiographs is obtained and, in addition to the above demonstrates multiple metallic fragments in the left frontal region. These are not recovered.

EVIDENCE OF INJURY

The ordering of the following injuries is for descriptive purposes only, and is not intended to imply order of infliction or relative severity.

Injuries of the head and neck:

There is an 8 x ¾ inch cluster of punctate abrasions on the forehead. A ⅜ x ¼ inch healing wound is present on the left side of the forehead.

Injuries of the extremities:

Incision of both wrists reveals subcutaneous hemorrhage of the dorsal radial surfaces measuring up to 2 inches on the right and up to 1 ¾ inches on the left.

INTERNAL EXAMINATION

BODY CAVITIES:

The body is opened by the usual thoraco-abdominal incision and the chest plate is removed. The ribs, sternum, and vertebral bodies are visibly and palpably intact. No adhesions or abnormal collections of fluid are present in any of the body cavities. All body organs are present in normal anatomical position. The subcutaneous fat layer of the abdominal wall is ¼ inch thick.

HEAD AND CENTRAL NERVOUS SYSTEM:
(See above "Evidence of Therapy")

The scalp is reflected. The galeal and subgaleal soft tissues of the scalp are free of injury. There are no skull fractures. The remainder of the calvarium is removed. Approximately 1 ml of turbid liquid material is expressed from the anterior region of the remaining central dura. The structures at the base of the brain, including cranial nerves and blood vessels are intact. The brain weighs 1700 grams. The atlanto-occipital joint is stable. The upper spinal cord is unremarkable. (See Neuropathological Consultation)

NECK:

The anterior strap muscles of the neck are homogenous and red-brown, without hemorrhage by layer-wise dissection. The thyroid cartilage and hyoid bone are intact. The larynx is lined by intact white mucosa. The tongue is free of bite marks, hemorrhage, or other injuries.

CARDIOVASCULAR SYSTEM:

The 340 gram heart is contained in an intact pericardial sac. The epicardial surface is smooth, with minimal fat investment. The coronary arteries are present in a normal distribution, with a right-dominant pattern. Cross sections of the vessels show widely patent lumina. The myocardium is homogenous, red-brown, and firm. The valve leaflets are thin and mobile. The endocardium is

smooth and glistening. The aorta gives rise to three intact and patent arch vessels. The renal and mesenteric vessels are unremarkable.

RESPIRATORY SYSTEM:

The upper airway is clear of debris and foreign material; the mucosal surfaces are smooth, yellow-tan and unremarkable. The pleural surfaces are smooth, glistening and unremarkable bilaterally. The pulmonary parenchyma is diffusely congested, exuding slight to moderate amounts of blood and frothy fluid; no focal lesions are noted. The pulmonary arteries are normally developed, patent and without thrombus or embolus. The right lung weighs 680 grams; the left 500 grams.

HEPATOBILIARY SYSTEM:

The 1180 gram liver has an intact smooth capsule covering moderately congested tan-brown parenchyma with no focal lesions noted. The gallbladder contains 12 ml of thick green-brown, mucoid bile; the mucosa is velvety and unremarkable. The extrahepatic biliary tree is patent, without evidence of formed calculi, however, the bile contains numerous yellowish-tan particles. The gallbladder is mildly distended.

GASTROINTESTINAL SYSTEM:

The esophagus is lined by gray-white, smooth mucosa. The gastric mucosa is arranged in the usual rugal folds and the lumen contains 300 ml of tan food material. The small and large bowel are unremarkable. The pancreas has a normal pink-tan lobulated appearance and the ducts are clear. The appendix is present.

GENITOURINARY SYSTEM:

The right kidney weighs 140 grams; the left 160 grams. The renal capsules are smooth, semi-transparent and strip with ease from the underlying smooth, red-brown cortical surface. The cortices are sharply delineated from the medullary pyramids, which are red-purple to tan and unremarkable. The calyces, pelves and ureters are unremarkable. White bladder mucosa overlies an intact bladder wall. The bladder is empty. The testes, prostate gland and seminal vesicles are without note.

LYMPHORETICULAR SYSTEM:

The 180 gram spleen has a smooth, intact capsule covering red-purple, moderately firm parenchyma; the lymphoid follicles are unremarkable. Lymph nodes in the hilar, periaortic and iliac regions are not enlarged.

ENDOCRINE SYSTEM:

The thyroid gland is symmetric and red-brown, without cystic or nodular change. The right and left adrenal glands are symmetric, with bright yellow cortices and red-brown medullae. No masses or areas of hemorrhage are identified.

MUSCULOSKELETAL SYSTEM:

No non-traumatic abnormalities of muscle or bone are identified.

NEUROPATHOLOGICAL CONSULTATION

GROSS DESCRIPTION:

Brain weight: 1528 gm

The specimen consists of an irregular 6 x 4 cm fragment of dura and the brain of an adult. The central portion of the dura is thickened and sclerotic. The subdural surface is covered by a 0.2 - 0.4 cm thick granular red-brown layer of adherent coagulated blood which contains fine shiny particles consistent with metallic fragments. There is a deep groove due to cerebral craniectomy herniation over each cerebral hemisphere. On the right, the area of cerebral herniation is approximately 12 x 8 cm and involves the dorsal/lateral surfaces of the frontal and parietal lobes and the anterior/lateral occipital lobe. On the left the area of the craniotomy herniation is 8 x 6 cm and involves the dorsal/lateral frontal lobe and the anterior and lateral temporal lobe. There are multifocal, small perivascular subarachnoid hemorrhages along the cortical grooves of the craniectomy herniation. The herniated cerebral cortex is markedly swollen, discolored a dusky gray and focally hemorrhagic and necrotic. There is no net midline shift due to the decompressive effect of the craniectomies but there is severe central transtentorial and transforamen magnum herniation. Deep bilateral tentorial grooves indent each uncus approximatcly 0.8 cm from the medial margins and the herniated cortex is necrotic. The diencephalon and internal capsules are markedly compressed elongated and hemorrhagic due to central transtentorial herniation. These hemorrhages are continuous with Duret hemorrhages in the tegmentum and base of the pons and the midbrain. A deep foramen magnum groove indents each cerebellar tonsil. The leptomeninges are moderately cloudy over the cerebral convexities. Elsewhere, they are thin, delicate and transparent. The perisellar, perimesencephalic and cerebellomedullary cisterns are compressed and effaced due to brain swelling. The arteries at the base of the brain follow a normal distribution and there are no aneurismal dilatations or sites of occlusion.

Coronal sections of the cerebrum reveal the above noted changes. There is cavitary necrosis of the left frontal lobe and disruption of the frontal pole cortex. The cavity causes destruction of the left frontal white matter, the striate body, the anterior corpus callosum, the septum pellucidum and the fornices.

MICROSCOPIC EXAMINATION:

Blocks of tissue for microscopic examination are removed from: (1) left frontal lobe, (2) midcorpus callosum/caudate/internalcapsule, (3) left hippocampus, (4) left thalamus/subthalamus/substantianigra, (5) right parietal lobe, (6) left occipital lobe (calcarinecortex), (7) cerebellum, (8) midbrain and (9) pons Sections from each block are stained with H&E, and LFB techniques and immunostained for GFAP and β-amyloid.

MICROSCOPIC FINDINGS:

Sections show generalized acute brain edema, congestion, focal hemorrhages and bland necrosis with no inflammation or granulation tissue. The hemorrhages are related to the craniectomy herniation margins as well as the subthalamic and rostral brainstem (Duret hemorrhages). There is no accumulation of macrophages and there is no leptomeningeal inflammation. This suggests that the severe brain swelling and central herniation resulted in compression of the penetrating blood vessels with necrosis without cellular infiltrate because of compression of regional blood flow. Surrounding the damaged areas there is widespread axonal injury (positive axons) in a vascular pattern.

COMMENT:

The pattern is consistent with a process such as cerebritis associated with metallic foreign bodies due to a penetrating injury resulting in massive brain swelling requiring bilateral craniectomies. The antibiotic treatment with drainage may have obscured the inflammation but the brain swelling progressed to central transtentorial herniation with subthalamic and rostral brainstem herniation hemorrhages.

ADDITIONAL PROCEDURES

1. Documentary photographs are taken by the OAFME photographer.
2. Specimens retained for toxicology testing and/or DNA identification are: vitreous fluid, blood, spleen, liver, lung, kidney, myocardium, bile, gastric contents, adipose tissue and psoas muscle.
3. The brain is retained for further examination. The remaining dissected organs are forwarded with the body.
4. Selected portions of organs are retained in formalin.

FINAL AUTOPSY DIAGNOSES

I. History of penetrating head injury
   A. Cavitary necrosis of the left frontal lobe
   B. Cerebral edema
      1. Cerebral craniectomy herniation with focal hemorrhage and necrosis
      2. Central transtentorial herniation with subthalamic and rostral brainstem herniation hemorrhages
   C. Retained intracranial metallic fragments

II. Additional injuries:
   A. Punctate abrasions of the forehead
   B. Healing wound of the left side of the forehead
   C. Blunt force injury of both wrists

III. Additional findings:
   A. Bilateral pulmonary congestion (right 680 mg, left 500 mg)

IV. Toxicology: Lidocaine present in the blood

OPINION

This 40 year old male civilian died of complications arising from penetrating head injury. According to reports, the decedent presented with a history of previous gunshot wound of the head with complaints of headache, diplopia, emesis and dizziness. He underwent CT and bilateral craniectomies for brain edema. The decedent's clinical status steadily declined postoperatively until his demise.

Autopsy examination showed extensive cerebral edema (brain swelling), cavitary necrosis of the left frontal lobe and minute metallic fragments. Additional injuries included punctate abrasions of the forehead (consistent with medical therapy) and evidence of blunt force injury to both wrists. No evidence of additional significant injury or natural disease was identified. Postmortem toxicological examination showed only the therapeutic agent lidocaine.

Since the exact etiology of the penetrating injury and the circumstances under which it occurred are uncertain, the manner of death is best classified as undetermined.

(b)(6)

(b)(6) Medical Examiner (b)(6)

CERTIFICATE OF DEATH *(OVERSEAS)*
Acte de décès (D'Outre-Mer)

NAME OF DECEASED (Last, First, Middle) Nom du décédé (Nom et prénoms)	GRADE Grade	BRANCH OF SERVICE Arme	SOCIAL SECURITY NUMBER Numéro de l'Assurance Social
BTB Marush, Muhammad, Fahdil Khamat		Civilian	(b)(6)

ORGANIZATION Organisation	NATION (e.g. United States) Pays	DATE OF BIRTH Date de naissance	SEX Sexe
	Iraq	(b)(6) 1968	[X] MALE [ ] FEMALE

RACE Race		MARITAL STATUS État Civil			RELIGION Culte		
[X]	CAUCASOID Caucasique	[ ]	SINGLE Célibataire	[ ] DIVORCED Divorcé	[ ] PROTESTANT Protestant	[X]	OTHER (Specify) Autre (Spécifier) UNK
[ ]	NEGROID Negroide	[ ]	MARRIED Marié	[ ] SEPARATED Séparé	[ ] CATHOLIC Catholique		
[ ]	OTHER (Specify) Autre (Spécifier)	[ ]	WIDOWED Veuf		[ ] JEWISH Juif		

NAME OF NEXT OF KIN Nom du plus proche parent	RELATIONSHIP TO DECEASED Parenté du décédé avec le sus
STREET ADDRESS Domicilié à (Rue)	CITY OR TOWN OR STATE (Include ZIP Code) Ville (Code postal compris)

MEDICAL STATEMENT Déclaration médicale

	CAUSE OF DEATH (Enter only one cause per line) Cause du décès (N'indiquer qu'une cause par ligne)	INTERVAL BETWEEN ONSET AND DEATH Intervalle entre l'attaque et le décès
DISEASE OR CONDITON DIRECTLY LEADING TO DEATH [1] Maladie ou condition directement responsable de la mort.	Complications of penetrating head injury	Months
ANTECEDENT CAUSES Symptômes précurseurs de la mort. MORBID CONDITION, IF ANY, LEADING TO PRIMARY CAUSE Condition morbide, s'il y a lieu, menant à la cause primaire		
UNDERLYING CAUSE, IF ANY, GIVING RISE TO PRIMARY CAUSE Condition morbide, s'il y a lieu, menant à la cause primaire		
OTHER SIGNIFICANT CONDITIONS [2] Autres conditions significatives		

MODE OF DEATH Condition de décès	AUTOPSY PERFORMED Autopsie effectuée [X] YES Oui [ ] NO Non	CIRCUMSTANCES SURROUNDING DEATH DUE TO EXTERNAL CAUSES Circonstances de la mort suscitées par des causes extérieures
[ ] NATURAL Mort naturelle	MAJOR FINDINGS OF AUTOPSY Conclusions principales de l'autopsie	Mode of Death : Undetermined
[ ] ACCIDENT Mort accidentelle		
[ ] SUICIDE Suicide	NAME OF PATHOLOGIST Nom du pathologiste (b)(6)	
[ ] HOMICIDE Homicide	SIGNATURE (b)(6) DATE Date 10 December 2008	AVIATION ACCIDENT Accident à Avion [ ] YES Oui [X] NO Non

DATE OF DEATH (day, month, year) Date de décès (le jour, le mois, l'année)	PLACE OF DEATH Lieu de décès
(b)(6) 2008 2245	Air Force Theater Hospital, Joint Base Balad Iraq

I HAVE VIEWED THE REMAINS OF THE DECEASED AND DEATH OCCURRED AT THE TIME INDICATED AND FROM THE CAUSES AS STATED ABOVE.
J'ai examiné les restes mortels du dé funtet je conclus que le décès est survenu à l'heure indiquée et à, la suite des causes énumérées ci-dessus.

NAME OF MEDICAL OFFICER Nom du médecin militaire ou du médecin assermenté	TITLE OR DEGREE Titre ou diplômé
(b)(6)	Medical Examiner

GRADE Grade	INSTALLATION OR ADDRESS Installation ou adresse
(b)(6)	Dover AFB, Dover DE
DATE Date 2/10/2009	SIGNATURE (b)(6)

[1] State disease, injury or complication which caused death, but not mode of dying such as heart failure, ect.
[2] State conditions contributing to the death, but not related to the disease or condition causing death.
[1] Préciser la nature de la maladie, de la blessure ou de la complication qui a contribué à la mort, mais non la manière de mourir, telle qu'un arrêt du coeur, etc.
[2] Préciser le condition qui a contribué à la mort, mais n'ayant aucun rapport avec la maladie ou à la condition qui a provoqué la mort.

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MEDCOM 1046

(REMOVE, REVERSE AND RE-INSERT CARBONS BEFORE COMPLETING THIS SIDE)

DISPOSITON OF REMAINS

NAME OF MORTICIAN PREPARING REMAINS	GRADE	LICENSE NUMBER AND STATE	OTHER

INSTALLATION OR ADDRESS	DATE	SIGNATURE
(b)(6)		

NAME OF CEMETERY OR CREMATORY	LOCATION OF CEMETERY OR CREMATORY

TYPE OF DISPOSTION	DATE OF DISPOSTION

REGISTRATION OF VITAL STATISTICS

REGISTRY *(Town and Country)*	DATE REGISTERED	FILE NUMBER	
		STATE	OTHER

NAME OF FUNERAL DIRECTOR	ADDRESS

SIGNATURE OF AUTHORIZED INDIVIDUAL

DD FORM 2064, APR 1977 (BACK) *USAPA V1.00*