Dutch Combat Operations Experiences in Iraq and Afghanistan

The Conundrum of Low Surgical Workload Deployments

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ABSTRACT

The Combined Joined Task Force - Operation Inherent Resolve (CJTF-OIR) is the military intervention of Iraq and Coalition Forces in the battle against ISIS. Al Assad Airbase (AAAB) is one of the important bases. It contains a Role 2 Medical Treatment Facility, primarily to perform Damage Control Surgery in Coalition and Iraqi Forces and Local Nationals. We present the 6 months medical exposure in order to provide insight into the treatment of casualties and to optimize medical planning of combat operations and (pre-/post-)deployment training. This is a cohort study of casualties that were admitted to the AAAB Role 2 from November 2017 to April 2018. Their mechanisms and types of injury are described and compared to those sustained in Uruzgan, Afghanistan between 2006-2010. Additionally, they are compared to the caseload in the Dutch civilian medical centers of the medical specialist team at AAAB. There were significant differences in both mechanism and type of injury between Coalition Forces (CF) and Iraqi National Security Forces (INSF) (p=0.0001). CF had 100% disease and non-battle injuries (DNBI), where INSF had 76% battle injuries and 24% DNBI casualties. The most common surgical procedures performed were debridement of wounds (36%), (exploratory) laparotomy (10%) and genital procedures (7%). The surgical caseload in Uruzgan, Afghanistan was significantly different in aspect and quantity, being 3.8 times higher. When compared to the workload at home all team members had at least a tenfold lower workload than in their civilian hospitals. The deployed surgical teams were scarcely exposed to casualties at AAAB, Iraq. These low workload deployments could cause a decline in surgical skills. Military medical planning should be tailormade and should include adjusting length of stay, (pre-/post-)deployment refresher training and early consultation of military medical specialists. Future research should focus on optimizing this process by investigating fellowships in combat matching trauma centers, regional and international collaboration and refresher training possibilities to maintain the expertise of the acute military care provider.

BACKGROUND

Operation Inherent Resolve (OIR) is the United States of America's (US) operational name for the military intervention against the so-called Islamic State of Iraq and Syria (ISIS, also known as Daesh). This includes both the campaign in Iraq and the campaign in Syria(1). On 17 October 2014, the US Department of Defense formally established the Combined Joint Task Force - Operation Inherent Resolve (CJTF-OIR) in order to formalize ongoing military actions against the rising threat posed by ISIS in Iraq and Syria(2). The mission of CJTF-OIR is to defeat ISIS in designated areas of Iraq and Syria and sets conditions for follow-on operations to increase regional stability. From January 2018 to December 2018, the Netherlands Armed Forces provides a surgical team (10 team members, consisting of 9 medical and 1 logistical member, textbox 1) conform the dual surgeon concept to assist in the CJTF-OIR mission on Ayn al-Asad Airbase (Al Assad Airbase [AAAB]) on a Role 2 Medical Treatment Facility (MTF). AAAB is an Iraqi Armed Forces and United States armed forces base located in the Al Anbar Governorate of western Iraq. The base is located in the Hīt District of the largely Sunni Al Anbar Governorate, about 100 miles (160 km) west of Baghdad and 5 miles (8.0 km) west of the village of Khan al Baghdadi. AAAB houses approximately 3,350 service members and contains a Role 2 MTF with approximately 50 multinational medical service members. The Dutch surgical team collaborates with a second NATO surgical team (Norway and United Kingdom) in shifts of 11 weeks. The Role 2 MTF was configured with three emergency resuscitation (ER) tables, one operating room (two surgery stations) and two Intensive Care Unit (ICU) beds. In addition, there were 4 Role 1 facilities on AAAB. The primary aim is to perform damage control surgery of Coalition Forces, Iraqi Security Forces and Local Nationals, the secondary aim is semi-emergency treatment, performed if resources permit them.

Box 1. Composition of surgical team at AAAB, Iraq.

Medical service member
1 Anesthetist
1 Nurse Anesthetist
2 ER/ICU nurses
2 (Trauma)Surgeons
2 Scrub nurses
1 Radiology technician
1 Logistic noncommissioned officer

ER = emergency room; ICU = intensive care unit.

The intense combat operations in Iraq and Afghanistan in the last three decades went hand in hand with a high casualty rate(3, 4). Currently, there are some conflict zones that are less hostile and present a consecutive low casualty rate(5). This low medical (surgical) work rate may cause a decline in medical skills of the deployed service members(6). The unpredictable development of the current asymmetric armed conflicts are a challenge in medical operational planning and selection.

The goal of this study is to determine the total medical exposure at Role 2 MTF AAAB, Iraq and the epidemiology of casualties. Furthermore, we firstly contrast our findings with the caseload in other MTFs of coalition partners in Afghanistan and Iraq and, secondly, with civilian medical (trauma) exposure in the Netherlands.

Ultimately, our findings in epidemiologic trends of casualties may provide insight to the treatment of casualties and medical planning of combat operations. The six month workload, volume, and type of injuries treated may also be useful in future planning of (pre- and post-) deployment training and other requirements of the Dutch and other military medical forces.

PATIENTS AND METHODS

This study was conducted under a protocol reviewed and approved by the Dutch Ministry of Defense (NL-MOD). A 'casualty' in customary military usage means an active duty service member lost to the theatre of operations for medical reasons. The term, therefore, includes disease (illness) and non combat/battle injuries (DNBI) as well as combat injuries. The definition of a battle casualty (BC) is as follows(7): a BC is identified as a service member being injured as a direct result of hostile action, sustained in combat or sustained going to or coming from a combat mission. For the purpose of this study, we included individuals killed or wounded accidentally by friendly fire directed at a hostile force or what was thought to be a hostile force.

Participants eligible for this study were selected from a general admission database of the NL-MOD who fitted the criteria BC and NBI between November 2017 and April 2018. We performed an inventory of records in the database of the Trauma Registry at Role 2 MTF AAAB and merged the casualty demographics with information from the medical records to identify the mechanism and type of injury. The casualties solely treated at the four Role 1 MTFs at AAAB were not included. After segregating the DNBIs, the BCs were divided into four groups: Coalition Forces (Danish, Great Britain [UK], Macedonian, Norwegian, USA); Iraqi Security Forces (composed of National Army, National Police, Security Guard); local nationals and civilian contractors.

The workload at Role 2 MTF AAAB was compared to our experiences during 2006-2010 in Uruzgan, Afghanistan(4). The workload of one surgical team was then compared with the workload in their respective civilian hospitals in the Netherlands.

Composition of surgical team

In the Netherlands, the Institute of Collaboration Defense and Relation Hospitals (IDR) of the NL-MOD is the central organ responsible for the training and deployment of military medical specialists. This was the first time a Dutch surgical team was deployed on a dual surgeon concept, one surgeon focusing primarily on visceral injuries and the other on ossal injuries. The surgical team consisted of ten team members: 1 Anesthetist/Intensivist; 1 Nurse Anesthetist; 2 ICU/ER nurses; 2 Scrub nurses; 2 Surgeons; 1 Radiology technician and 1 logistic noncommissioned officer (non-medical).

In the period May-July 2018 surgeon 1 was a trauma surgery consultant at a Level 1 Trauma Center in an Academic Teaching Hospital and Surgeon 2 was primary vascular and trauma surgery consultant at a Level 2 Trauma Center in a Teaching Hospital and secondary in a Level 1 Academic Teaching Hospital. In contrast to most NATO coalition partners, in the Netherlands trauma surgeons are trained in surgical treatment of both ossal and soft tissue injuries.

Statistical analysis

In calculating the anatomical distribution of wounds we excluded the unknown cases to correct for missing data. Statistical analyses were performed using a computerized software package, SPSS (version 24, IBM Corporation, Armonk, NY, USA). The categorical variables were analyzed based on their absolute and relative frequencies in percentages. The association between two categorical variables was calculated by applying the Pearson v2 squared test. In all cases, $p < 0.05$ was considered statistically significant.

RESULTS

During the 6 month period studied (November 2017-April 2018), a total of 84 casualties (BC 39 [46.4%], DNBI 44 [52.4%], 1 [1.2%] unknown) were treated at the Role 2 MTF AAAB. The combined study population was predominantly male 92.9% (20 unknown sex), with a mean age of 33.5 years.

Casualty statistics

There was a significant difference (p=0.0001) in the mechanism and type of injury when coalition forces were compared with INSF (Table 1). CF had 100% (19/19) DNBI casualties, where INSF had 76% (22/29) BI and 24% (7/29) DNBI casualties. Similarly, INSF were more often victims of explosions 59% (17/29) and GSW 17% (5/29) than were coalition forces (explosions n=0, GSW DNBI n=2 [suicide]).

Table 1
Mechanism of injury casualties AAAB, Iraq during a 6 month period (November 2017 – April 2018).

Patient category	BI Explosion	BI GSW	BI UNK	DNBI Accident	DNBI Burns	DNBI illness	Total
CF	0	0	0	10 (53)	0	9 (47)	19 (31)
CC	0	0	0	3 (38)	0	5 (62)	8 (13)
INSF	17 (59)	5 (17)	3 (10)	4 (14)	0	0	29 (48)
LN	0	0	0	1 (20)	3 (60)	1 (20)	5 (8)
Total	17 (28)	5 (8)	3 (5)	18 (30)	3 (5)	15 (24)	61*

Data are presented as N (%) unless otherwise indicated.
BI = Battle Injury; GSW = Gunshot Wound; UNK = unknown; DNBI = Disease Non Battle Injury.
CF = Coalition Forces; CC = Civilian Contractor; INSF = Iraqi National Security Forces; LN = Local Nationals.
* The mechanism of wounds is calculated without the unknown cases (n = 23).

Table 2
Surgical procedures at Role 2 Medical Treatment Facility AAAB, Iraq versus Surgical procedures at Role 2 Medical Treatment Facility Uruzgan, Afghanistan.

Procedures performed	BC n	DNBI n	Total n	Procedures Uruzgan 6 m (4 yr)
Head/ neck	3	0	3	21 (170)
Thoracotomy/ pericard window	1	0	1	3 (22)
Chest drain	5	0	5	8 (61)
Laparotomy				
DEF	7	0	7	14 (113)
DCS	1	0	1	16 (125)
Genitals	4	1	5	4 (29)
Major amputation	3	0	3	10 (81)
Minor amputation	0	0	0	6 (45)
Vascular intervention	4	0	4	3 (21)
Extremity ORIF	1	0	1	20 (161)
External fixation	3	0	3	26 (208)
MUA	0	1	1	7 (54)
Fasciotomy/ escharotomy	3	0	3	8 (61)
DID	23	3	26	103 (820)
DIS	0	0	0	13 (105)
Reconstruction/ SSG	3	0	3	14 (113)
Minor (general) surgery	1	1	2	6 (50)
Total procedures	62	6	68	280 (2239)

BC = battle casualty; DNBI = disease non-battle casualty; n = number m = months; yr = years.
DEF = definitive surgery; DCS = damage control surgery; ORIF = open reduction internal fixation/wiring; MUA = manipulation under anesthesia; DID = debridement, irrigation, and dressing; DIS = debridement, irrigation, and splinting; SSG = split skin graft.

Surgical procedures at AAAB, Iraq and in Uruzgan, Afghanistan

The surgical procedures (n=72) performed at Role 2 MTF AAAB were composed of the spectrum of surgery, as described in Table 2. The most common surgical procedures performed (by any specialty) were irrigation and debridement of wounds 36% (26/72), followed by (exploratory) laparotomy 10% (7/72), and genital procedures 7% (5/72). The fifth column of the table displays the absolute amount of all surgical procedures (280) during the deployment of Task Force Uruzgan, Afghanistan 2006-2010 (high surgical workload deployment) corrected for a six month period, which was 3.8 times higher and significantly different (p=0.0001).

Workload surgical team

The surgical team consisted of nine medical team members each with specific tasks. The workload during deployment in Iraq and regular workload in the civilian hospitals in the Netherlands is described per function of medical team member in Table 3. All team members had at least a tenfold higher workload at home due to the low workload during deployment. Of all the team medical members the radiology technician had the highest workload in AAAB, however this was still ~12% of his workload at home.

In a two month period in the Netherlands, surgeon 1 performed 44 trauma procedures (~30% urgent, all trauma surgical patients) and surgeon 2 performed 88 procedures (~10% urgent; comprised of 40 vascular, 28 trauma, 20 general surgery) in their respective hospitals. The weekly workload of non-Operation Room (OR) related patient contact at home was estimated at 60 consults per surgeon. This includes emergency room trauma resuscitation and the treatment of severely injured patients; screening and treatment of monotrauma patients; intensive care rounds; work in the outpatient clinic and consultation. This was ~20 times higher than their Non-OR workload at Role 2 MTF AAAB.

DISCUSSION

The total operative surgical workload during a six month period in AAAB Iraq was four times lower than during high workload deployments like Task Force Uruzgan, Afghanistan. The caseload was ~70 procedures, divided equally between BC and DNBI. The caseload for surgeons was 2-4 times lower than the regular workload at home and even lower for other surgical team members.

These low workload deployments could cause a decline in skills of the surgical team members and might lower the operational readiness of an MTF. Although this is beyond the scope of this study it would be valuable to examine. In the current theater of war there are several low workload missions, for example during the Dutch anti-piracy missions there is a low casualty rate and a minimal surgical

Table 3
Workload of the surgical team at AAAB, Iraq versus regular amount of procedures in civilian hospital.

Medical service member	N of patients in on AAAB NOR/OR	N of patients in civilian hospital*
Anesthetist	5	130
Nurse Anesthetist	5	60
ICU nurse	5	41
ER/ICU nurse	9 ER/ 1 ICU	70 ER/22 ICU
Surgeon 1	49 NOR/ 3 OR	~400 NOR/ 44 OR
Surgeon 2	49 NOR/ 3 OR	~400 NOR/ 88 OR
Scrub nurse 1	5	42
Scrub nurse 2	5	33
Radiology technician	41	253

N = number; NOR = non-Operation Room; OR = Operation Room; ICU = Intensive Care Unit, ER = Emergency Room.
* 2 month period.

workload. During the NATO mission Ocean Shield and the European Union mission Atalanta in the Somali Basin, the Gulf of Aden, and the Arabic Sea, the surgical exposure was limited to in total two perianal abscesses during a period of 6 months (2015). Another example is the situation in Kunduz, Afghanistan. In a 3-month period (2012), at the German Role 2 MTF in Kunduz 27 surgical procedures were performed; 90% of these were for DNBI orthopedic trauma(5).

Deering et al. (6) reported a perceived degradation in both the surgical and clinical skills among US military consultants deploying for >6 months, where the degradation was correlated with the length of deployment. However, Dutch military surgeons and anesthetists that were stationed in Uruzgan, Afghanistan between 2006-2010 reported a positive influence of the deployment on their professional skills(12). This can be attributed to the fact that it was a high-workload deployment and also significantly shorter (3 months) than the US deployments. Deering et al. (6, 8) did not stratify for workload and there was a large variety of (surgical) specialists. Both factors could have influenced the outcome.

To prevent a decline in surgical skills, short deployments (a maximum of six weeks) should be considered during low-intensity missions with correspondingly reduced surgical workload, especially for the (junior) medical specialists in dual surgical teams. Furthermore, refresher training (pre-, per- and post-deployment) could be provided with standardized approach to these needs and a goal of maintaining full scope primary care providers(8). The NL-MOD is in the final phase of formalizing dedicated fellowships in South Africa. This training could be routinely attached to a low intensity deployment as a refresher training. Regional collaboration for military surgeons in the divers national and international high volume Trauma Centers, including regional duty shifts and exchange programs, are also a possible solution for a surgical team to refresh their essential surgical skills. The regional collaboration is cheap and easy to implement and it leads to mutual understanding in the military civilian collaboration. Braun et al. (9) describe the challenges for military surgeons during low combat injury periods and they propose high workload civilian level 1 trauma centers as a solution for the required exposure. Training fellowships and regional collaboration can also be implemented to optimally match the required competences of military surgeons and other medical personnel that normally work in low-volume trauma centers.

There are additional arguments to make for short deployments. Firstly, it would prevent deployment overload of our relatively small group of deployable medical specialists. This, in combination with a classification of type of surgeon, could reduce the operational tempo for the medical specialist. Secondly, it would preserve the military surgeon's applicability of (re)certification by national surgery boards. The Dutch Surgery Board, as in most other nations, dictates rigid guidelines concerning volume of patients needed to be treated by a surgeon to apply for (re)

certification per surgical sub-specialization. This is also an argument for fellowship in high volume trauma centers which receive trauma victims similar to those seen in armed conflict areas.

Deployment overload is another challenge most NATO forces face and several other solutions could be considered. Civilians (non-medical contractors) that are hired to support military personnel are common in recent conflicts(10). The use of non/ex-military highly trained and "battle proven" medical personnel as an extension to the deployable pool of surgical team members could be a solution within NATO forces.

Highly qualified specialists as portrayed in this study should be considered as Special (Operations) Surgical teams who can be deployed swiftly and extracted rapidly as team or individual team member. The regular "hand-over-take-over" periods (up to two weeks) in the beginning and end of a deployment are non-pragmatic and unnecessary for these "plug and play" surgical teams. These solutions would make it possible to match surgeons to deployments, with the possibility to upscale or downscale considering the casualty rate, type of injury, and workload(5).

Combat operations rarely follow a set pattern; any situation can instantly change so the staged approach should not mean compromising over the required surgical skill set. As non-surgeon surgical team members do not report a self-perceived decline in skills(11), they probably are at a lower risk of skill declination. Breaking teams in separate deploying units might result in a decrease in team bonding. From operational planning perspective, however, individualized deployment of surgical team members could be a solution and it is therefore a regular procedure within NATO deployments. Tailor-made medical forethought should be part of the initial battle planning, in which early consultation by experienced military surgeons is highly recommended.

The conundrums identified in this article are challenges to be faced by the NL-MOD in future collaboration with civilian hospitals in the Netherlands(12). Creating a pool of medical specialists with a clear differentiation between a senior, junior, and trainee medical specialist and their specific skill set for different violence spectra with concomitant injury types and volumes could be advantageous for the hospitals, the military surgeons, and the MOD.

There are certain limitations to our study. Incomplete or missing medical charts may have led to an underestimation of the number of (non) surgical procedures performed. Coalition partners reported poor population description, (medical) casualty definitions data points, and poor consistency of pre-hospital data entered into medical registration systems(13). In order to limit these lacunae in the data, the US established the Joint Theater Trauma Registry (JTTR) in 2004, a standardized system of data collection that was designed to encompass all echelons of the medical support organization. For the same reasons the Netherlands are implementing

the similar Military Trauma Registry, which is compatible with the national trauma registry(14).

CONCLUSIONS

The deployed surgical teams were scarcely exposed to casualties at AAAB Iraq during the period November 2017-April 2018. These low workload deployments could cause a decline in surgical skills. Military medical planning should anticipate effective use of the highly trained surgical team members by adjusting the length of stay to the expected workload during deployment. Tailormade planning should ideally include (pre-/post-)deployment refresher training when necessary and early consultation of military medical specialists. Future research should focus on fellowships to high volume "combat matching" trauma centers, (inter)national and regional collaboration and refresher training possibilities to maintain the full scope of expertise of the acute military care provider.

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