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SURGICAL ABSTRACTS

Oral presentations

THE SIGNIFICANCE OF RADIATION EXPOSURE TO SURGEONS DURING SENTINEL LYMPH NODE BIOPSY

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Introduction: To measure the extent of radiation exposure to a surgeon after injecting 91 patients undergoing sentinel lymph node biopsy with radioactive isotope technetium-99m.

Method: A prospective analysis of 91 patients undergoing sentinel lymph node biopsy who received radioactive isotope technetium-99m for the period 5 January 2010 - 20 June 2010.

Results: A total of 91 patients' exposure rates were collected by placing a thermoluminescent dosimeter (TLD) on the surgeon's finger. The TLDs recorded the total radiation exposure to the surgeon.

The occupational dose limit for extremity exposure should be less than 500 mSv or 50 rem per year. The data, once analysed and extrapolated, showed an average dose per patient of 0.1110989 mSv.

Conclusion: The number of surgical procedures a surgeon would need to perform to exceed the advised minimum extremity dose limit would need to exceed 4 545.5 per annum. Therefore, only in extreme surgery practices would the minimum dose limit of extremity radiation be exceeded. The data also reveal that regular measurements of radiation exposure and radiation protective measures need not be undertaken in theatres where surgeons are working with radioactive isotopes regularly.

OVERCOMING RESOURCE RESTRICTIONS – INTRA-OPERATIVE RADIOTHERAPY FOR BREAST CANCER WITH EXISTING INFRASTRUCTURE IN A DEVELOPING COUNTRY

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Introduction: Radiation services are at a premium in developing countries and prolonged courses of radiation tax the compliance of a largely poor and rural population. Single-fraction, definitive intra-operative radiation (IORT) for breast cancer is ideal for these circumstances, but is currently reserved for resource-rich environments. From 2002 to 2005 a pilot series of IORT was conducted in an extremely resource-restricted environment with adaptation of existing infrastructure. We present medium-term follow-up data.

Methods: After clinically complete tumour excision a specially developed applicator was introduced into the tumour bed. An existing after-loader with an Ir192 seed was used to deliver 21 Gy in a single fraction to the tumour bed. Then the applicator was removed and the wound closed. Further regional and systemic oncological management followed established protocols. Data recorded were age, menstrual status, stage, complications, recurrence and survival.

Results: Thirty-nine patients were treated; the average age was 55 years (range 35 - 68 years); 14 patients had TNM stage 1, 22 stage IIA and 2 stage IIB cancers; the majority were infiltrating ductal carcinomas; the mean tumour diameter was 19 mm; and 4 patients were node positive. After a mean follow-up of 84 months, 1 patient suffered a local recurrence, 4 regional recurrences and 3 had systemic metastases. One patient died of disease and 2 of unrelated causes, giving an overall local control rate of 95%, an overall survival of 90% and a disease-specific survival of 95% at 5 years.

Conclusion: In this limited study, IORT using existing after-loaders and a low cost, self-developed applicator has similar local control rates at 5 years to external beam radiation (EBRT). Utilisation of scarce health care resource in resource-restricted environments is greatly reduced. This extends breast conservation to indigent patients who cannot adhere to lengthy EBRT protocols.

AN AUDIT OF THE QUALITY OF INITIAL TRAUMA RESUSCITATION IN A REGIONAL HOSPITAL

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Introduction: The initial appropriate resuscitation of trauma patients will impact positively on their subsequent clinical course. This pilot study reviews the quality of initial trauma resuscitation at a regional hospital in South Africa.

Methods: This was a prospective descriptive study. Inclusion criteria were all trauma patients admitted to the intensive care unit (ICU) who received their initial resuscitation in our institution. The admission notes were reviewed independently by two consultant intensivists. Neither had been involved in the initial patient management.

Results: A total of 20 cases were audited. Three of these (15%) had no documentation at all by admitting staff. In the remaining patients, the mechanism of trauma was penetrating (47%) and blunt (53%). Only 64% of doctors wrote their name, and only 44% the date and time when the patient was seen. In 17% of cases the cervical spine was assessed with appropriate placement of a collar. The airway was assessed in 47% of cases, breathing in 43% and circulation in 50%. The Glasgow Coma Scale (GCS) was assessed in 53% and the pupils in 29%. The temperature was not taken in

a single patient. In 23% intravenous lines were inserted, with 29% receiving fluids. Only 35% had a urinary catheter inserted and 35% were given analgesia. Only 21% of patients were seen again for review before theatre or ICU admission. An emergency operation was done in 71% of cases, with an average time to theatre of 11 hours and duration of operation just under 4 hours.

Conclusion: Although poor record keeping makes it difficult to assess the quality of our resuscitation accurately, it does appear that acceptable protocols are generally not followed in our institution.

BRCA MUTATION DETECTION RATE IN BREAST CANCER PATIENTS AT TYGERBERG HOSPITAL, WESTERN CAPE

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Introduction: Breast cancer remains one of the most frequent tumours in women. BRCA1 and 2 genes play a major role in the hereditary susceptibility to this disease. In a developing country, lack of supporting services such as clinical genetics means that surgeons often have to take the initiative in establishing such services in the management of breast cancer. We present an audit of testing for disease-causing BRCA mutations in a diverse patient population of Afrikaner, Xhosa and mixed ancestry with a high incidence of breast cancer.

Method: An audit was conducted for breast cancer patients undergoing BRCA diagnostic testing from March 2005 to November 2010. Initial testing was for 3 Afrikaner 'founder' mutations and occasionally for other common mutations. A subgroup underwent protein truncation testing (PTT) for selected exons. Indications for testing were age <35 years, bilateral breast cancer at any age, multiple family members with breast and/or ovarian cancer, and all male patients with breast cancer.

Results: Of 221 patients tested, 35 (15.7%) had BRCA mutations. Of the 221 patients tested for common mutations, 23 (10.3%) had Afrikaner 'founder' mutations (15 had the BRCA2 8162delG mutation) and 11 had one of the other 'less common' mutations. A positive PTT was observed in only 9 (7%) of 130 patients tested. Four of 13 males tested positive for BRCA mutations.

Conclusion: The 10.3% detection rate for the common mutation testing is good, for the testing criteria applied, and the diverse patient population. The BRCA2 mutation was detected in 7.1% of all patients tested. This study supports the use of non-stringent criteria for common mutation testing even in a diverse population. The increased availability of genetic testing and the potential influences on management of the individual patient make it imperative that surgeons know the indications and implications of genetic testing and are able to apply it in the management of breast cancer in a multidisciplinary setting.

PROGNOSIS AND TREATMENT COST OF SCREEN-DETECTED VERSUS SYMPTOM-DETECTED BREAST CANCER IN SOUTH AFRICA

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There is a paucity of data on the prognosis and cost of primary therapy of breast cancer of screen-detected versus symptomatic breast cancer. We present an estimation of prognostic impact and a detailed cost analysis of the treatment of screen- versus symptom-detected breast cancers as a basis for further exploration.

Methods: From a prospective database of a breast health centre in Cape Town, South Africa, 100 consecutive cases each of screen- and symptom-detected breast cancer were identified. Treatment followed the Van Nuys criteria for DCIS and internationally recognised protocols for infiltrating carcinomas. Costs for all components of therapy for each patient were obtained from providers. A 10-year prognosis was estimated from Van Nuys data for DCIS, adjuvantonline and NSABP data for infiltrating carcinomas.

Results: Screen-detected cancers were diagnosed earlier than symptomatic cancers. Surgical therapy costs were not different between the two groups (R7 820 219.00 v. R7 221 067.00; $p=NS$). Radiotherapy costs (R2 980 176.00 v. R4 421 620.00; $p=0.0024$) and systemic therapy costs (R6 837 851.00 v. R 10 257 025.00; $p=0.002$) were significantly lower in the screen-detected cancers, as was the total average treatment cost (R176 382.46 v. R218 997.12; $p=0.054$). Estimated 10-year mortality (7% v. 19%, $p=1\times 10^{-10}$) and recurrence (16% v. 30%, $p=3\times 10^{-10}$) rates were lower.

Conclusion: While high-quality screening does not decrease the surgical costs of therapy, it not only leads to earlier diagnosis of breast cancer with improved survival and decreased recurrence rates but also concurrent lower costs of radiation and systemic treatments.

SCREENING MAMMOGRAPHY READ BY BREAST SURGEONS

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Introduction: Mammography was pioneered by surgeons but is now considered the domain of radiologists. With ever-increasing cost pressures it must be decided whether interpretation of mammography by clinicians and radiation technologists is comparable to that of breast radiologists. We present the largest series of surgeon-read screening mammography to date.

Methods: All mammography performed between 2003 and 2010 at a comprehensive breast centre was recorded prospectively. First assessment was by a mammographer and consensus established after a second reading by an experienced breast surgeon who took responsibility for the reading. Data recorded were age, hormonal replacement therapy, prior breast surgery, indications for mammography and outcomes. Outcomes were classified on the basis of the Breast Imaging and Reporting Data System (BIRADS). Indeterminate lesions were imaged further or underwent tissue acquisition. All BIRADS 5 lesions underwent tissue acquisition.

Results: Of 15 069 mammograms, 670 were reported as indeterminate/compatible with malignancy; 302 biopsies were performed and 109 cancers diagnosed. In 40 - 49-year-old women (6 262 mammograms), the recall rate was 4.2%, the biopsy rate 1.6%, the malignancy rate of biopsy 23.7%, and the cancer diagnosis rate 3.6/1 000 examinations; for 50 - 69-year-old women these figures were 8 231, 4.7%, 2.2%, 44.1% and 10.0/1 000, and for women older than 70 years they were 576, 5.6%, 3.4%, 33.3% and 11.2/1 000. Of all cancers, 32.2% were non-invasive; of invasive cancers, 49.1% were 10 mm or less in diameter and 75% were node-negative.

Conclusions: These results are similar to those in high-quality organised screening programmes. The role of breast surgeons in mammography interpretation should be expanded.

FOLLOW-UP MAMMOGRAPHY OF THE CONSERVED BREAST – CAN IT DETECT RECURRENCE EARLY?

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Annual mammography is among the recommended procedures in follow-up after primary therapy for breast cancer, despite there being only very few data to support this practice; there are even less data for mammography in conserved breasts. In order to contribute to the discussion and to provide data from a developing country for the first time, we report a large series of mammograms in after breast conservation according to standard performance parameters.

From a prospective database of all mammographies at a tertiary breast centre in Cape Town, data were extracted on all mammographies performed after breast-conserving therapy for breast cancer. Mammography was performed annually as part of a standard protocol for the follow-up of patients after primary therapy of breast cancer. Standard craniocaudal, mediolateral oblique views were taken as well as special views if indicated.

Data recorded were the age of the patient, stage at initial diagnosis, current hormonal therapy, prior breast surgery, the indication for and outcome of mammography, and further work-up. The outcome of the mammography was classified according to the BIRADS. The method of further imaging and/or tissue acquisition, histology and clinical staging were recorded.

Of a total of 12 506 mammograms performed between January 2003 and June 2010, 2 250 were done after breast conservation (21 after bilateral breast conservation). Fifty-three were done for

commercially available in South Africa in 2006. We report the experience of applying a 70-gene expression profile (MammaPrint® (MP)) in a South African cohort.

For hormone receptor-positive TNM stage 0 - II tumours in patients aged 35 - 70, fresh tumour samples were taken and gene expression profiled. Demographic data, tumour staging and detailed histopathology were recorded. Adjuvant therapy was based on MP results and compared with the St Gallen recommendations. Ten-year survival data were projected with either adjuvantonline or published data on MP.

From 2006, 17 tests failed owing to insufficient material. For 50 tumours, the clinical staging was 0 in 4, I in 34 and II in 12. The average histopathological tumour size was 16.5 mm, and 34 were node negative. Fifteen tumours were concordantly reported as high risk and 12 as low risk; 8 St Gallen low-risk tumours were reported as high risk by MP, and 15 St Gallen high-risk tumours were reported as low risk by MP. Chemotherapy was recommended for 30 patients according to St Gallen for an average absolute reduction of recurrence of 7.8% and mortality of 3.9%; MP prognostication led to a recommendation for chemotherapy for 23 patients for an absolute 12.3% reduction in recurrence and 6.9% for mortality. Two MP high-risk tumours and none of the low-risk tumours have recurred.

MP prognostication led to treatment changes in 46% of cases with a reduction in chemotherapy recommendations; it allocates chemotherapy more appropriately than histopathological parameters.

Examination	N	BIRADS 3 - 5	Biopsies	Cancer (N)	Cancer rate	Average tumour size
Asymptomatic conserved breast	2 182	71 (3.2%)	41 (1.9%)	23	10.5/1 000	18 mm (11 cases)
Asymptomatic contralateral breast	2 104	51 (2.4%)	21 (1.0%)	16	7.6/1 000	24 mm (8 cases)
Mass in the conserved breast	31	19 (62%)	16 (51%)	15	48%	24 mm (8 cases)
Mass in the contralateral breast	3	2	1	1	-	-

special indications. Of 2 197 mammograms, 2 163 were done for asymptomatic patients and 34 for patients presenting with a mass. The average age of the patients was 60 years.

Follow-up mammography presents a complex problem for performance parameter analysis owing to the presence of a number of selection biases. In the conserved as well as the contralateral breast, the detection rate is higher than in standard screening mammography. Mammography can detect asymptomatic recurrence early.

FIVE YEARS OF TRANSCRIPTIONAL PROFILING OF BREAST TUMOURS IN A SOUTH AFRICAN COHORT

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Molecular prognostic profiling of breast tumours became

COLORECTAL CANCER IN KWAZULU-NATAL: AN ESTABLISHED DISEASE WITH A VARIABLE CLINICOPATHOLOGICAL SPECTRUM

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Introduction: Colorectal cancer (CRC) is among the top 10 cancers in South Africa and is a major contributor to the burden of disease. Once considered to be a rare cancer in Africa, recent evidence suggests that this trend may be changing.

Aim: This study was undertaken to establish the clinicopathological patterns of CRC among the different population groups in KwaZulu-Natal province, South Africa.

Patients and methods: All patients diagnosed with CRC at the University of KwaZulu-Natal teaching hospitals between 1 January and 31 December 2009 were considered eligible for the study. After

histological typing, the patients' medical records were studied to determine demographics, clinical presentation, site of lesion, staging and grading of carcinoma. Patients are being followed up to document treatment and resultant outcomes.

Results: A total of 485 patients were recruited into the study (black 19%, Indian 19%, coloured 10% and white 52%). The mean age was 62.97 years (standard deviation 14.97 years), and blacks were significantly younger (51 years) than all the other groups combined (61 years) ($p<0.0001$). The most common site in all population groups was the rectum (43 - 50%), followed by the sigmoid colon (13 - 25%) and the right colon (18 - 33%), with resection rates of 50% (black), 68% (Indian), 69% (coloured) and 7% (white). Staging was similar in the different population groups, namely stage I 2 - 9%, stage II 15 - 30%, stage III 25 - 38% and stage IV 7 - 13% ($p=0.08$). Of the black patients 25% were aged ≤ 40 years, and the black population represented 66% of all the patients who were ≤ 40 years of age.

Conclusion: Colorectal cancer is an established disease that presents earlier among blacks. It has a variable clinicopathological spectrum. The site distribution, disease stage and tumour differentiation were found to be similar to those observed internationally. Site distribution and staging were similar in patients presenting at younger and older ages.

AUDIT OF LAPAROSCOPIC EXPERIENCE IN DURBAN COLORECTAL UNIT

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Aim: To review our experience with establishing laparoscopic colorectal surgery in Durban with a view to recommending a protocol to establish laparoscopic surgery in developing units.

Method: Review of laparoscopic procedures performed in the Durban colorectal unit during the period 2008 - 2010. Procedures performed, conversion rate and outcome were reviewed. Data were collected prospectively and analysed retrospectively

Results: Results reflect a single surgeon's experience in the Durban colorectal unit for the period January 2008 up to and including December 2010, during which time a total of 45 laparoscopic procedures were attempted.

Eight procedures were performed in 2008. The conversion rate was 63% (5/8). The only successful procedures were two laparoscopic closures of Hartmann's colostomy and an AP resection.

Eleven procedures were performed in 2009. The conversion rate was 45% (5/11). Although operative procedures were carefully selected, the high conversion rate during this period is attributed to poor patient selection. Five of the 6 successful procedures were left-sided colectomies.

Twenty-six procedures were performed in 2010, 21 after July. The conversion rate was 15% (4/26), all for bulky tumours in the small male pelvis where visibility was too poor to proceed safely. All were converted to lower midline laparotomy with good outcomes.

The overall mortality in this series is 2% (1 patient, who died of respiratory failure).

Conclusions: Laparoscopic surgery can be safely implemented

in reasonably high-volume units provided it is done in a safe and careful manner. It is imperative to have established laparoscopic skills before attempting colorectal surgery. It is recommended to proceed initially with simple benign procedures before attempting more complex procedures or surgery for carcinomas.

TRACKING THE COURSE OF COMPLICATED APPENDICITIS THROUGH A REGIONAL HOSPITAL AND DEVELOPING FEEDBACK MECHANISM TO REFERRING DISTRICT HOSPITALS

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Introduction: There are no easily quantifiable methods to measure and benchmark the quality of surgical services in an area. Using a single common surgical disease as a marker of the quality of care in an area would allow us to establish norms and assess improvements in care. Acute appendicitis is a surgical disease that would be an ideal marker as it is common and poor outcome is not entirely dependent upon technical factors but rather on systematic failures. Based on the overall presentation pattern and the complications of the above cohorts of patients, an attempt has been made to construct a scoring system that reflects the quality of acute surgical care in the region.

Methodology: A colour-coded Excel-based system has been used to track all ICU admissions in our institution since 2008. This system allows us to link the patient back to the referral hospital. Data from this tracking system are used to provide direct feedback to each referral hospital on a monthly basis. Since September 2011, all patients with appendicitis treated at our institution have been collated into a prospective database. The referral point is recorded as well as the duration of symptoms and any associated delay in diagnosis or referral. All complications are recorded and classified as major or minor complications.

Results: Edendale Hospital services four referring district hospitals in southern KwaZulu-Natal. Since September 2010 a total of 61 patients were admitted with acute appendicitis. In 22 a laparotomy was performed, in 36 a Lanz incision and in 3 a laparoscopy. The following findings were noted: early appendicitis (24), perforated/gangrenous appendicitis with localised sepsis (27), perforated with four quadrant sepsis (12). There were 3 negative appendicectomies. There were 18 patients who required ICU admission, 13 who required a re-laparotomy, 14 open abdomens and 2 pneumonias. There were 4 deaths (6%). A total of 16 patients were referred from a district hospital. There were 33 self-referrals directly to our institution and 10 referrals from GPs or local clinics. The average duration of symptoms before seeking any attention was 2.6 days. The average delay in diagnosis once contact had been made with the health care system was 8 hours.

Conclusion: Patients present with a long duration of illness before seeking medical attention. Those who were initially assessed in the peripheral hospitals experienced a significant delay before transfer to Edendale Hospital for definitive management. This reflects a poor surgical service, and interventions are necessary to improve the quality of our service. The rate of major complications may be a useful marker for the quality of surgical care; however, individual hospitals see too few cases for it to be a useful grading system for specific institutions.

DEATHS AT A LEVEL 1 TRAUMA UNIT: A CLINICAL FINDING AND POSTMORTEM CORRELATION STUDY

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Background: Missed injuries continue to cause deaths among trauma patients. It is important to identify *all* injuries at any stage in the care of trauma patients in order to improve patient outcome. This study was performed to evaluate to what extent missed injuries contribute to a fatal outcome in a new level 1 trauma unit.

Methods: The medical records and autopsy reports of all trauma patients who died at the IALCH trauma unit from March 2007 through August 2009 were reviewed. The mortality rate and incidence of missed injuries were determined. A missed injury was defined as one that was found at autopsy but was not mentioned in the medical records or in any antemortem radiological report. This excluded minor injuries such as superficial contusions and minor lacerations, which are sometimes not included in the case notes during resuscitation. Deaths due to trauma are considered unnatural, and legal provisions require that all unnatural deaths undergo medico-legal postmortem examination. The study was approved by the UKZN Biomedical Research Ethics Committee.

Results: 547 patients were admitted to the trauma unit, of whom 135 (24.7%) died. Three patients were excluded owing to inability to retrieve their autopsy reports, leaving a study group of 132 patients (100 males and 32 females). The mean age was 33.2 years, and the mean ISS was 34.0. A total of 26 missed injuries were found in 14 patients, giving a total incidence of 10.6%. Three per cent had missed injuries that were variously deemed to be *possibly related*, *probably related* or *related* to the fatal outcome. Severe physiological derangement which precluded any imaging before death may have caused the injury to be overlooked. The thorax was the anatomical region where most injuries were missed.

Conclusions: A number of injuries remain undetected in trauma care and are found only at autopsy, emphasising that the autopsy remains an important tool in evaluating trauma care. However, in only a few patients did the missed injuries have a potentially detrimental effect on outcome.

DIRECT ADMISSION VERSUS INTER-HOSPITAL TRANSFER TO A LEVEL 1 TRAUMA UNIT IMPROVES SURVIVAL: AN AUDIT OF THE NEW INKOSI ALBERT LUTHULI CENTRAL HOSPITAL TRAUMA UNIT

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Objective: To audit the performance of a new level I trauma unit and trauma intensive care unit.

Methods: Data were retrieved from the hospital informatics system and an independent database in the trauma unit for patients admitted to the level I trauma unit and trauma intensive care unit at Inkosi Albert Luthuli Central Hospital, Durban, from March 2007 to December 2008.

Results: 407 patients were admitted; 71% were from other hospitals and 29% directly from scene (DIR). The median age was 27 years (range 1 - 83), and 71% were male. Blunt injury accounted for 66.3% of admissions and penetrating trauma for 33.7%. Of the former, motor vehicle-related injury accounted for 87.4%, with 81% of paediatric admissions due to pedestrian injuries. The median ISS for the entire cohort was 22 (survivors 18, deaths 29; $p<0.001$). Patients in the DIR group had a significantly higher mean ISS compared with the IHT group (DIR 25, IHT 20; $p<0.02$). The overall mortality rate was 26.3%. There were 37 (31.1%) deaths in the DIR group and 70 (24.3%) in the IHT group ($p=0.19$). In patients surviving more than 12 hours the overall mortality rate was 21.1% (DIR 13.7%, IHT 23.5%; $p=0.042$).

Conclusions: Trauma is a major cause of premature death in the young. Despite a significantly higher median ISS in direct admissions, there was no difference in mortality. Among those surviving more than 12 hours, patients admitted directly from scene had a significant decrease in mortality. Dedicated trauma units improve outcome in the critically injured.

A CRUSHING EXPERIENCE: THE SPECTRUM AND OUTCOME OF SOFT-TISSUE INJURY AND MYONEPHROPATHIC SYNDROME AT AN URBAN SOUTH AFRICAN UNIVERSITY HOSPITAL

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Objective: The aim of the study was to assess the level of creatinine kinase (CK) associated with significant renal dysfunction, the correlation between body surface area (BSA) involved and CK level, and correlation between BSA injury and renal dysfunction to enable BSA prediction to identify 'at risk' patients.

Methods and materials: Retrospective review of Tygerberg Hospital Trauma Service patients between January 2003 and December 2005 with a screening CK level >500 U/l. Data were captured on a proforma. BSA was scored charting body surface bruising using a rule-of-nines. The study was approved by the Departmental Research Committee.

Results: 334 records were reviewed. 89% were men, mean age 30 years and average Revised Trauma Score 7.5. Blunt trauma constituted 75%, with blunt force assault 64% of the total. CK of >8 500 U/l predicted renal injury/failure ($p<0.01$). BSA and CK correlated very well in the blunt group ($p<0.01$). Linear correlation was found between BSA and the development of renal dysfunction/failure ($p<0.01$), with BSA $>18\%$ predicting renal impairment. While 83% of patients developed renal risk/injury, only 17% required dialysis. Mortality was 5%. Most deaths were multi-trauma MVAs, requiring ICU care and dialysis, and multi-organ dysfunction was the cause of death. The high-CK group (>5 000 U/l) had a worse outcome compared with the low-CK group (500 - 5 000 U/l), with higher peak urea (17.2 mmol/l v. 12 mmol/l), peak serum creatinine (2 836 mmol/l v. 140 mmol/l) and rate of renal dysfunction/failure (20% v. 8%). The penetrating group (97% male) included vascular injuries with increased CK due to ischaemia-reperfusion injury and low BSA, mainly due to gunshot wounds (70%). Three patients (10%) developed renal failure and had abnormal CK levels (range 538 - 32 540 U/l). There were

2 deaths in this group and both these gunshot wound patients developed significant rhabdomyolysis with subsequent renal failure and multi-organ failure.

Conclusion and recommendation: Screening CK accurately stratifies patients at risk for myonephropathic syndrome. Early aggressive fluid loading can prevent renal injury/failure. Adjunctive measures have not improved outcome. Patients sustaining vascular and severe extremity injury from penetrating wounds should also be routinely screened.

THE USE OF LAPAROSCOPY TO DIAGNOSE AND MANAGE DIAPHRAGMATIC INJURIES IN HAEMODYNAMICALLY STABLE AND NON-PERITONITIC PATIENTS WITH PENETRATING THORACO-ABDOMINAL INJURIES

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Introduction: Penetrating left-sided thoraco-abdominal trauma may result in occult diaphragmatic injury. Laparoscopy allows the surgeon to diagnose and repair such occult injuries. This prospective study reviews our experience with laparoscopic diagnosis and repair of occult diaphragmatic injury.

Method: All patients with left-sided penetrating thoraco-abdominal injuries, without an indication for an emergency operation, were subjected to a diagnostic laparoscopy after a period of at least 24 hours' observation. When a diaphragmatic injury was detected, laparoscopic repair was done. A prospective database is maintained on each patient.

Results: Fifteen patients were enrolled in this study. The male/female ratio was 14:1 and the average age was 27 (range 15 - 43). There were 14 stabs and 1 GSW. Five patients (33%) had a diaphragmatic injury, 2 being diaphragmatic breaches and 3 acute diaphragmatic hernias. The average length of the injury was 2 cm, with a range of 1 - 5.5 cm. Seven patients had abnormalities on CXR but only 2 had diaphragmatic injuries. All the acute diaphragmatic hernias contained omentum. All the diaphragmatic injuries were repaired laparoscopically. In 1 patient a laparotomy was necessitated by an associated gastric injury. The average duration of surgery in the negative patients was 41 minutes (range 25 - 80 minutes). When there was a diaphragmatic injury the average duration of surgery was 92 minutes (range 60 - 151 minutes). No intra-operative or immediate postoperative complications occurred.

Conclusion: The incidence of diaphragmatic injury is 33%. CXRs cannot be used to establish the presence of diaphragmatic injuries. The use of minimally invasive techniques is both safe and effective in diagnosing and repairing the diaphragmatic injury.

THORACO-ABDOMINAL STAB WOUNDS IN THE HAEMODYNAMICALLY UNSTABLE PATIENT WITH POTENTIAL INJURIES IN MULTIPLE BODY CAVITIES

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In the setting of the hypovolaemic patient with a thoraco-abdominal stab wound and potential injuries in both the chest and abdomen, deciding which cavity to explore first may be difficult. Opening the incorrect body cavity can delay control of tamponade

or haemorrhage and exacerbate hypothermia and fluid shifts. This situation has been described as one of double jeopardy.

Methods: All stab victims from July 2007 to July 2009 requiring a thoracotomy and laparotomy at the same operation were identified from a database. Demographics, site and nature of injuries, admission observations and investigations as well as operative sequence were recorded. Correct sequencing was defined as first opening the cavity with most lethal injury. Incorrect sequencing was defined as opening a cavity and finding either no injury or an injury of less severity than a simultaneous injury in the unopened cavity. The primary outcome was survival or death.

Results: Sixteen stab victims underwent thoracotomy and laparotomy during the same operation. All were male, with an age range of 18 - 40 years (mean/median 27). Median systolic blood pressure on presentation was 90 mmHg (quartile range 80 - 90 mmHg). Median base excess was -6.5 (quartile range -12 to -2.2). All the deaths were the result of cardiac injuries. Incorrect sequencing occurred in 4 patients (25%). In this group there were 4 negative abdominal explorations prior to thoracotomy with 2 deaths. There was 1 death in the correct sequencing group.

Conclusion: Incorrect sequencing in stab victims who require both thoracotomy and laparotomy at the same sitting is associated with a high mortality. This is especially true when the abdomen is incorrectly entered first while the life-threatening pathology is in the chest. Clinical signs may be misleading, leading to incorrect sequencing of exploration. The common causes for confusion include failure to appreciate that cardiac tamponade does not present with bleeding and difficulty in assessing peritonism in an unstable patient with multiple stab wounds. In the setting of the unstable patient with stab wounds and suspected dual-cavity injuries, the chest should be opened first, followed by the abdomen.

CURRENT TRAUMA PATTERNS IN PIETERMARITZBURG

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Introduction: Trauma remains a major health care burden in South Africa. This study examined the pattern of trauma in Pietermaritzburg over the period 2006 - 2009, seeking to identify trends in injury pattern and overall trauma load.

Methods: The study consisted of three separate retrospective audits. The first audit reviewed all the trauma admissions to ICUs in Pietermaritzburg from January to December 2007. The second audit reviewed all patients with penetrating thoracic trauma admitted by the metropolitan surgical service over the 3-year period from July 2006 to July 2009. This clinical audit was accompanied by an audit of the victims of penetrating thoracic trauma that were brought to the police mortuary in Pietermaritzburg over the same period. The third audit reviewed all the trauma patients admitted by the Pietermaritzburg metropolitan complex over the period June - December 2009. These data were taken from the weekly metropolitan morbidity and mortality meeting.

Results: During 2007 a total of 179 trauma patients were admitted to ICUs in Pietermaritzburg. There were 48 (27%) gunshot wound (GSW), 60 (33%) stab wound (SW) and 71 (40%)

blunt trauma victims. The mortality rate was GSW 25%, SW 13% and blunt trauma 14%. Over the 3-year period July 2006 - July 2009 a total of 1 186 patients, of whom 77 were female, with penetrating chest trauma were admitted to the surgical services in Pietermaritzburg. There were 1 062 SWs and 124 (14%) GSWs. For the same period 676 victims of penetrating thoracic trauma were taken to the mortuary. There were 135 (20%) GSWs of the chest in the mortuary cohort. Of the total of 259 GSWs, 52% were admitted directly to the mortuary compared with 541 (33%) of the 1 603 SWs. Over the period June - December 2009 a total of 850 trauma victims were admitted to the surgical services. The breakdown was blunt 54%, GSW 9%, SW 34%. There were 463 victims of blunt trauma, of whom 328 (70%) were assaulted and 135 (30%) victims of a motor vehicle accident. There were 377 victims of penetrating trauma, of whom 296 (78%) had stab wounds.

Conclusion: GSWs have stabilised at between 14% and 20% of penetrating trauma victims, but remain more lethal than stab wounds. Interpersonal blunt trauma is high by developed world standards; however, we are experiencing a significant problem with motor vehicle-related trauma.

AN AUDIT OF ERROR ASSOCIATED WITH THE INITIAL MANAGEMENT AND REFERRAL OF ACUTE TRAUMA PATIENTS IN WESTERN KWAZULU-NATAL

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Introduction: Western KZN is a large area with approximately 3 million people. Many of these patients live in remote areas. In the event of sustaining major trauma, these patients will be treated at a clinic or district hospital. The periphery is plagued with chronic under-staffing and high staff turnover, resulting in trauma care of an extremely uneven quality.

Methodology: We have maintained a database of all trauma referrals from the periphery to our tertiary service in Pietermaritzburg. We have classified all inappropriate and problematic referrals according to four criteria. These are assessment problems, resuscitation problems, logistical problems and operative problems. Assessment problems are errors of planning. Resuscitation problems, operative problems and logistical problems are errors of execution

Results: Over the period July 2009 - June 2010 we received 756 trauma referrals from the periphery. There were 65 (9%) problematic referrals in this period. Of these problematic referrals there were 12 female patients and 1 9-month-old child; the rest were adult males. The average age was 34 years. Blunt trauma was a problem in 40 patients. There were 7 GSW victims, 17 stab victims and 1 burn victim. There were 43 assessment problems, 9 resuscitation problems, 7 logistical problems and 6 operative problems. There were 11 (16%) deaths. Three patients required amputation because of failure to recognise a vascular injury. Renal failure developed in 3 patients due to inadequate resuscitation. Two patients were transferred with untreated pneumothorax. Both developed a tension pneumothorax and 1 died. Cervical spine injuries were not recognised in 2 patients. Delay in diagnosing peritonitis was a problem in 14 patients.

Conclusion: There are significant deficits in trauma care in our referring hospitals. These translate into significant morbidity

and mortality. Inadequate assessment and understanding of the pathology being treated is a major problem. Planning errors are more common than execution errors. This has implications for how we teach trauma care in the periphery.

AN AUDIT OF FAILED SELECTIVE CONSERVATIVE MANAGEMENT OF STABBED ABDOMENS

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Introduction: Selective non-operative management based on clinical assessment has been shown to be a generally safe approach in the management of penetrating stab wounds of the torso. However, there will be a subset of patients who fail selective non-operative management. This audit focuses on the failures.

Methods: The metropolitan surgical service in Pietermaritzburg covers three hospitals. At the weekly metropolitan morbidity and mortality meeting all trauma patients are reviewed. All cases of failed selective non-operative management of penetrating abdominal stab wounds are discussed. Failed non-operative management is usually defined as any patient who ultimately requires surgical exploration. We do not subscribe to this, as we feel as long as the need for surgical intervention is recognised within a short period of time (<12 hours) there is little additional morbidity. Recognition of the need for surgical intervention after 12 hours would be regarded by us as failed non-operative management, as we feel that the risk of delay-associated morbidity begins to increase significantly after this time.

Results: A total of 340 patients with a penetrating anterior abdominal stab wound were managed over the 2-year period under review. A total of 192 (56%) of these patients were subjected to mandatory laparotomy. Of these mandatory laparotomies, 98% were positive. The remaining 148 (44%) patients were observed. Of the 148 observed patients, a total of 30 (20%) subsequently underwent surgery. A total of 13 patients were only taken to surgery after 12 hours of observation. In this group of 13 patients the average delay between admission and recognition of injury was 40 hours. There were 6 gastric injuries, 1 pyloric and pancreatic injury, 2 gallbladder injuries, 1 liver injury, 1 colon injury and 2 small-bowel injuries. There were no deaths. Nine patients recovered with no additional morbidity. In the remainder, morbidity included re-laparotomy (1), open abdomen (1), renal failure (1) and prolonged stay in the ICU (3).

Conclusion: Clinical assessment accurately predicts the need for mandatory laparotomy following a stab wound to the torso. In patients who do not meet the indications for mandatory laparotomy and who are subjected to non-operative management, 20% will come to surgery. A subgroup may only be recognised as requiring surgery after more than 12 hours. These patients are at risk of delay-associated morbidity. There are particular anatomical sites and structures that are prone to error.

ARE CHEST X-RAYS NECESSARY AFTER CHEST TUBE INSERTION IN TRAUMA EMERGENCIES?

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Johannesburg Hospital is a level I trauma centre in Gauteng. We routinely do chest X-rays (CXR) in indicated cases, if feasible, and

prefer to perform a CXR after intercostal drain (ICD) insertion to maintain quality and direct further care.¹

Aim: To audit the value of CXR after chest tube insertion in trauma patients.

Method: A prospective data collection of patients who had injuries that required the insertion of an ICD over a period of 8 months from 1 August 2006 to 30 March 2007. A questionnaire was developed, including the patients' demographics, mechanism of injury, reason for ICD insertion, findings of both the initial and post-ICD insertion CXR, any change in management and any acute complications noted.

Results: 140 patients were identified for the study, 129 (92.1%) being males and 11 (7.9%) females. The average age was 32 (range 11 - 64) years. Eighty-four (60%) patients sustained stab wounds and 20 (14.3%) gunshot wounds. The remaining 36 (25.7%) sustained blunt injury. One hundred and four (74.3%) patients had ICDs inserted for both radiological and clinical findings, while 19 (13.6%) patients had drains inserted due to radiological findings and 14 (10%) patients on clinical grounds only. Three (2.1%) patients had drain insertion due to CT scan findings. In patients who had an initial CXR, clinical and/or radiological findings confirmed 47 (36.7%) patients with haemopneumothoraces, 49 (38.3 %) with pneumothoraces, 26 (20.3%) with haemothoraces, 4 (3.1%) with significant surgical emphysema with fractures, and 2 (1.6%) with abnormalities on CXR. No acute complications of chest tube insertion were noted.

In 89 (63.6%) patients, post-ICD CXR showed good position of the drain with improvement in pathology, in 31 (22.1%) inadequate ICD position was noted, in 17 (12.1%) significant retained haemothoraces were shown, and in 3 (2.1%) poor lung expansion was detected. The post-ICD CXR contributed to change in management in 29 (20.7%) of the cases; 22 (15.7%) patients required a change in position of the tube, 6 (4.3%) had surgery performed, and 1 (0.7%) had their conservative treatment escalated. Four (2.9%) should have had their tubes adjusted.

Conclusion: Routine use of post-ICD CXR contributes to a change in management in 1 out of 5 trauma patients.

DO TRAUMA PATIENTS ON VENTILATORS IN THE EMERGENCY DEPARTMENT NEED MULTIPLE BLOOD GAS ANALYSIS TO OPTIMISE TREATMENT?

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The importance of adequate ventilatory support after severe trauma is heavily stressed. However, this may lead to a tendency to hyperventilate trauma patients put on ventilator in the emergency department.

Aim: To investigate whether trauma patients on ventilator in the emergency department are hyperventilated.

Method: A prospective collection of data for trauma patients put on ventilators in the emergency department. The questionnaire included demographic information, indication for ventilation, analysis on initial and repeat arterial blood gases, and management changes. Patients were recruited over a period of 6 months from 1 November 2006 to 30 April 2007.

Results: Fifty-nine patients were identified; 54 (91.5%) were males and 5 (8.5%) were females. Ages ranged from 4 to 60 years. The indication for ventilator treatment was isolated head injury

in 28 (47.5%) patients, polytrauma in 13 (22%), polytrauma with severe head injury in 9 (15.3%), and isolated airway and ventilation indication in the remaining 9 (15.3%). Thirty-seven patients had a Glasgow Coma Scale (GCS) of 3 - 8, 13 had a GCS of 9 - 12, and 9 had a GCS of 13 - 15. The first arterial blood gas was done within 10 minutes of ventilator treatment in 48 (81%) of the cases, whereas the second was done within 90 minutes in 41 (69.5%) of the cases. In 23 (39%) patients the pCO₂ was less than 30 mmHg on the first gas, and in 19 (32%) on the second gas. Oxygenation was adequate, with levels above 200 mmHg in 40 (68%) of initial and 47 (80%) of second gases. The most common ventilatory manipulation was a reduction in minute volume after the first gas in 14 (24%). Reduction of inspiratory oxygen was the most common change after the second gas in 28 (47%). The number of cases that should have had ventilatory adjustment was reduced from 12 (20%) after the first arterial blood gas to 1 (1.7%) after the second.

Conclusion: Although there was a tendency to hyperventilate patients on ventilators in the emergency department in our institution, satisfactory ventilation was achieved almost uniformly after the second blood gas analysis.

CERVICAL AERO-DIGESTIVE TRACT INJURIES AT THE JOHANNESBURG HOSPITAL TRAUMA UNIT

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Introduction: Cervical trauma poses a great challenge to trauma surgeons, and the anatomical and physiological implications of trauma to this small, compact body region packed with vital structures are enormous. Airway obstruction and exsanguinating haemorrhage are the most important immediate risk to life.

Fortunately aero-digestive tract injuries are relatively uncommon (7% penetrating, very rare in blunt trauma).

In the past 10 - 15 years surgeons all over the world have changed the classic approach of mandatory exploration of wounds involving the platysma into a selective conservative intervention policy, thus eliminating the risks of non-therapeutic surgical neck explorations.

Method: A description of the retrospective review of prospectively collected data from the digital trauma registry at Charlotte Maxeke Johannesburg Hospital Trauma Unit (JHTU) (Medibank, www.medibank.co.za) of patients diagnosed with aero-digestive injuries (pharynx, larynx, trachea, oesophagus or combined) between January 2005 and December 2009.

Inclusion: penetrating or blunt trauma to the neck, irrespective of associated injuries or final outcome.

Variables collected and discussed: age, sex, mechanism of injury, anatomical location, primary organ injury, associated injuries, Injury Severity Score (ISS) on admission, surgical intervention or non-operative management and overall mortality.

Results: During the study 10 992 patients with major trauma were treated at JHTU. Of those 49 (0.44%) had cervical trauma involving aero-digestive organs. The vast majority were males (N=44; 89.7%) between ages of 15 and 30 years (range 20 - 50). Forty-three patients had penetrating trauma, 27 (55.1%)

presented following gunshot wounds (GSWs), 16 (32.6%) had stab wounds and 6 (12.2%) had blunt mechanisms of injury. The mean calculated ISS was 16 (range 2 - 42). Zone II of the neck was the most common point of entry ($N=27$, 55.1%).

Laryngeal injury was the commonest, in 18 patients (36.7%, 15 penetrating v. 3 blunt), followed by oesophageal injury in 17 (34.6%, 16 penetrating v. 1 blunt), pharyngeal injury in 14 (28.5, 12 penetrating v. 2 blunt) and tracheal injury in 7 (14.2%, all penetrating); 42 patients (85.7%) had one or more associated injuries.

The majority of the patients underwent emergency surgery (neck exploration and primary repair of injury or primary tracheostomy), and only 7 had non-operative management of their cervical aero-digestive injuries. The overall mortality was 16.3%; there were no deaths related to stab wounds, but 28.5% of patients with GSWs and 33.3% with blunt trauma died.

EARLY FACTORS PREDICTING OUTCOME OF DAMAGE CONTROL LAPAROTOMIES

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Introduction: Damage control surgery carries a high mortality, and the decision to do such surgery may be made too late. There is a need for early decision-making in both the emergency room and theatre. The surgeon needs key parameters to aid decision-making.

Aim: To identify early predictors of mortality due to inadequate organ perfusion (first 48 hours after injury), and predict the need to perform (earlier) damage control surgery.

Materials and methods: Retrospective review of damage control laparotomies recorded on the trauma registry of CM Johannesburg Academic Hospital Trauma Unit (1 May 2005 - 31 December 2009). Various parameters were compared between survivors and non-survivors, a p -value of <0.05 being deemed statistically significant

Results: Gunshot wounds were the most common mechanism of injury in both groups. Survival at 48 hours was 55% ($N=100/181$).

Regression analysis showed the best predictors of mortality to be: resuscitation pH ($p=0.0003$), intra-operative volume of colloid ($p=0.0078$), blood, temperature and pH base deficit (all $p<0.0001$), and blood loss ($p=0.0025$)

Conclusions: Emergency room parameters that significantly predicted mortality and the need for damage control surgery were: pH, base deficit, lactate and Revised Trauma Score (RTS). Intra-operative parameters that significantly predicted mortality were: temperature, metabolic acidosis, and volume of colloid and/or blood transfused.

NECROTISING ENTEROCOLITIS: EARLY CONVENTIONAL AND FLUORESCIN LAPAROSCOPIC ASSESSMENT

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Aim: Clinical and radiological diagnosis of necrotising enterocolitis (NEC) can be difficult. With radiological diagnosis, severity and complications such as perforation and full thickness necrosis may often not be obvious. This study aimed to establish early diagnosis of full-thickness necrosis by using fluorescein

laparoscopy before perforation occurred. It also aimed to assess perforation before it was evident on radiology by conventional laparoscopy.

Patients and methods: 13 patients with pre-operative presumed clinical and/or radiological diagnosis of NEC underwent laparoscopy. A 4.7 mm umbilical or left upper quadrant port was inserted for camera using the open method. The abdominal cavity was inspected for bowel ischaemia, fibrin, adhesion formation and presence of free intestinal contents. If necessary, one or two 3 mm working ports were inserted for manipulation of the bowel. Seven of these cases had photodynamic diagnosis (PDD) following intravenous injection of fluorescein.

Results: The average age of the patients was 20 days (range 3 - 38 days). Their average weight was 1 427 g (910 - 2 415 g). The first 5 patients had laparoscopy only and 8 subsequent patients had fluorescein-aided assessment added to the laparoscopy.

Conventional laparoscopy identified perforation and/or gangrenous bowel in 8. One patient was found to have chyle ascites, and 1 had no abnormal findings on laparoscopy. Fluorescein identified gangrenous bowel in 3 additional patients. Laparotomy and necessary surgical intervention were performed in all 11 patients with positive laparoscopy findings.

Conclusion: Laparoscopy helps to improve assessment of patients with a presumed diagnosis of NEC. It allows early identification of perforation and necrosis. Where ischaemia is suspected, fluorescein laparoscopy has an added benefit of identifying necrotic segments.

THERAPEUTIC LAPAROSCOPY IN TRAUMA: THE NEW PARADIGM

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Introduction: Laparoscopy in trauma is controversial at best and regarded as dangerous in some circles. Earlier data published in the early 1990s reported a high missed rate of small-bowel injury in particular. These early data set off a firestorm in this arena and many trauma surgeons have been very reluctant to embrace it in trauma care.

Aim: We document our results using laparoscopy in treating trauma patients in our unit.

Methods: We prospectively collected the records of all patients treated at our institution using minimally invasive surgery. The patients' demographic data, operative findings, procedure and outcomes were looked at during January 2009 and January 2011. We excluded patients who had a soft abdomen with lower stab chest with suspected diaphragm injury, as these have routine diagnostic laparoscopy in our unit.

Results: During this time 47 patients were treated using this modality (28 males, 19 females). They were all haemodynamically stable with a tender abdomen or suspected intra-abdominal injury. Six had disembowelment, 4 gunshot wounds of the abdomen, 23 stab wounds of the abdomen, 12 blunt abdominal trauma, and 2 suspected diaphragm injury with a tender abdomen.

Procedures done were repair of the colon (6 cases), small-bowel repair (12), combined small-bowel and colon repair (4), stomach repair and diaphragm repair (9), splenectomy (2), bladder repair (4), cholecystectomy and hepatorrhaphy (2), non-

remedial laparoscopy (8), and conversion to open (5). The mean operating time was 2 hours and the average hospital stay 4 days. Complications were missed injury in 1 case, resulting in fistulas, multiple organ failure and death, wound sepsis (2), pneumonia (1), and prolonged ileus (1).

Conclusion: There is cautious optimism that minimally invasive surgery may have a role in trauma. The caveat is that it should be done in a closely supervised environment by trained individuals.

Poster presentations

THORACIC TRAUMA: THE NELSON MANDELA ACADEMIC HOSPITAL EXPERIENCE

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Introduction: Injuries to the chest have high mortality due to interaction between three pathophysiological mechanisms: bleeding, hypoxia, and direct cardiac injury. The three visceral compartments of the chest, two pleural spaces and the mediastinum, are particularly susceptible to pressure elevation resulting from accumulation of undrained air or blood. About 70 - 80% of patients with chest injuries do not require operative intervention and can be managed safely by means of intercostal drainage (thoracostomy tube). Nelson Mandela Academic Hospital in Mthatha, Eastern Cape, is the provincial hospital and trauma centre for 2 million inhabitants. Most of the trauma patients who arrive at the hospital have penetrating injuries due to stabs and gunshots. This communication presents our results in the management of our patients.

Aims:

1. To characterise the frequency of thoracic trauma seen at our institution.
2. To present our management of blunt and penetrating thoracic injuries.
3. Mortality rate.

Method: Our study included all patients admitted as emergencies from January 2009 to December 2009 inclusive. It was an observational, prospective and descriptive study for evaluating the behaviour of emergency principal causes of thoracic trauma admission and the mortality.

Results: We analysed the records of all patients (149) were admitted to our hospital during 2009 with thoracic trauma. The commonest age of admission was 15 - 34 years, with a male preponderance. Intercostal drainage was done in all patients (100%), and thoracotomies were done in 15 complex injuries (10.06%) with a mortality rate of 2.01% (3 patients).

Conclusions: Our statistics are comparable to international reports and the management was successful, with a slightly lower mortality.

PARASITIC CYSTS OF THE SPLEEN: REPORT OF 2 CASES

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Introduction: Infection due to *Equinoccocus granulosus* is a

frequent cause of mesenteric cyst. Poor hygienic conditions in rural areas increase the infection in animals and humans. The diagnosis of hydatid cyst is based on the findings of an enzyme-linked immunosorbent assay (ELISA) for echinococcal antigens, and results are positive in approximately 85% of infected patients. Ultrasound and computed tomography (CT) scans of the abdomen are both quite sensitive for detecting hydatid cysts, and histological examination of specimens after resection confirms the diagnosis of the disease. Amoebic infections, not commonly found a few years ago, are emerging nowadays as amoebomas, colitis, abscesses and pseudocysts.

Aims: To present 2 cases of splenic cysts caused by parasites.

Results: Most hydatid cysts (70%) form in the liver. A few ova pass through the liver and are held up in the pulmonary capillary bed or enter the systemic circulation, forming cysts in the lung, spleen, brain, bones, etc.

Amoebiasis is an uncommon cause of diarrhoea in this region, and even less common are complications following infection.

A case of hydatid cysts of the spleen, and a second case of splenic cyst secondary to *Entamoeba*, will be presented.

Conclusions: Parasitic cysts are relatively frequent in rural areas. However, presentation in the spleen is rare. We report 2 cases with huge cysts formed in the spleen. Ultrasound and CT images, the surgical procedure and morphology of the surgical specimen are presented in both instances. Splenectomy and total resection of cysts was done. The patients were followed up in the surgical outpatient department until they were finally discharged.

MESENTERIC CYSTS

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Introduction: Mesenteric cysts are benign tumours frequently found during surgical procedures due to different causes. The primary tumours of omentum can be found as solid or cystic masses. They usually originate from mesenteric lymphatics which produce closed spaces with fluid within. The size of these cysts can be enormous. They can be attached to the gastro-intestinal tract, or originate in solid organs.

This paper presents the cases we handled at hospital during the last 3 years.

Aims: To illustrate the characteristics of mesenteric cysts treated at our hospital.

Results: Non-parasitic, peritoneal cysts are regarded as the most frequent type of mesenteric cysts nowadays. Tumours developed from mesenteric root are quite rare, according the literature reviewed. This paper presents our findings of an omental cyst, the blood supply of which emerged from the upper mesenteric artery. The cyst was attached to duodenum, small bowel and large bowel.

Conclusions: Mesenteric cysts are uncommon conditions due to embryological defects. Acquired, non-parasitic omental cysts, however, present more often in this region compared with ones caused by abnormal development of mesentery. Local statistics and demographics relating to this condition are presented, as well as ultrasound and computed tomography images, morphology and surgical procedure in one case.

LAPAROSCOPIC PROCTORSHIP IN A RESOURCE-CONSTRAINED ENVIRONMENT – HOW FAR CAN WE GO?

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Introduction: Laparoscopic skills are historically thought to be for tertiary institutions and for senior surgeons. The feasibility of training medical officers in minimally invasive surgery has never been looked at before in a South African context.

Aim: The aim of this presentation is to document the cases done by a medical officer who has been trained in a non-tertiary hospital and to raise awareness of the feasibility of this venture.

Method: This was a retrospective review of all the cases done by a single medical officer over a 9-month period (1 April - 31 December 2010). The records of all the cases done during this time were investigated, specifically looking at demographic data, the procedure done, the time of the procedure and the outcome.

Results: Over this period 34 laparoscopic cases were done: 30 appendicectomies including 11 perforated appendices with generalised peritonitis; 1 perforated peptic ulcer with a Graham patch; and 3 cases of trauma (2 stabbed abdomen and 1 blunt abdominal trauma).

The 30 patients who had appendicectomies comprised 14 males and 16 females, with a mean age of 27 years for males (range 7 - 49) and 23 years for females (8 - 42). Mean anaesthetic time was 98 minutes (60 - 120), and mean hospital stay 4 days (1 - 13). There was 1 complication, a patient with a collection that needed a relook.

Conclusion: Minimally invasive surgery skills can be taught to everybody. This procedure can be done safely and training should be extended to all.

CASE REPORT: SPILLED STONES – ANY CONSEQUENCES?

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Background: In October 2010 a 77-year-old woman presented to our casualty department with a superficial cystic fluctuant right upper quadrant (RUQ) mass with surrounding erythema that had been present for 9 months. Her first consultation had been in March 2010, when the mass had been present for 2 weeks. She reported malaise and pain but no constitutional symptoms, and had no significant medical history or allergies. In August 2009 she had a laparoscopic cholecystectomy in a private clinic to which she was admitted with acute cholecystitis. Intra-operative findings revealed a gangrenous gallbladder with a short cystic duct. Dissection was difficult and the gallbladder was perforated with stones left in the peritoneal cavity. On clinical examination, the patient was toxic with a tender fluctuant RUQ superficial mass measuring 8×5 cm.

Special investigations and management: Ultrasound (26 March 2010): superficial right hypochondrial mass with hypo- and hyper-echoic components, 3×4 cm², arising from the liver. Computed tomography of the chest/abdomen (28 March): normal CT chest, RUQ abdominal wall abscess extending from the liver margin with multiple calculi. This was then treated as a super-infected amoebic liver abscess. Bloods (22 November): elevated inflammatory markers, evidence of renal dysfunction, amoebic/hydatid/hepatitis

studies negative. Non-contrast CT of the abdomen (22 November): RUQ abdominal wall abscess with calculi within.

The patient was taken to theatre for drainage of this collection and 3 calculi measuring 1.5 cm in diameter were removed. The wound was irrigated and continued to drain purulent material. There was concern regarding a fistulous communication with the colon, but a urografin enema ruled out this possibility.

The patient's condition settled on antibiotic treatment and saline flushings of the wound.

Discussion: The most common intra-operative complications of laparoscopic cholecystectomy include bleeding and spilled stones. The latter occurs with a frequency of up to 30%. Spilled cholesterol stones pose little threat of infection, but pigment stones may harbour viable bacteria and therefore potentially lead to infectious complications. Recent case reports document a clear potential for long-term infectious complications of retained stones, which is contrary to traditional teaching. The recommendation is avoidance of perforation, a careful search for escaped stones, and liberal use of a plastic retrieval bag for large and friable gallbladders.

Conclusion: This case suggests that spilled stones after laparoscopic cholecystectomy should be actively retrieved and not brushed off as a benign complication.

ANOMALOUS ORIGIN OF THE VERMIFORM APPENDIX

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Introduction: An anomalous origin of the veriform appendix is an extremely rare anatomical condition. We present one such case discovered at 'routine appendicectomy'.

Case report: A 32-year-old man presented with symptoms and signs of acute appendicitis. At appendicectomy, the appendix was noted to be arising from the hepatic flexure of the colon. Histology confirmed a 7 cm long appendix specimen with intramural inflammatory cells.

Discussion: Anomalies of the veriform appendix are very rare (<0.005%). These include agenesis, horseshoe appendix, duplication and triplication. The anomalous origin of the appendix can be explained by an embryological theory of differential growth. Caecal growth on the medial side of the appendix is more prominent than on the lateral side. This results in an ostium appendicis verminiformis situated more cephalad and lateral on the right colon.

Conclusion: Although they are rare, a greater awareness of appendiceal anomalies is essential, especially among junior surgical residents. Failure to recognise them may result in serious clinical and medico-legal consequences.

NECROTISING ENTEROCOLITIS: EARLY CONVENTIONAL AND FLUORESCIN LAPAROSCOPIC ASSESSMENT

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Minimally invasive surgery (MIS) is increasingly performed in adults and children. The equipment and instruments used for MIS are very different to those for open surgery. Surgeons need to interact with equipment to perform successful operations.

Specialised equipment includes monitors, insufflators, light sources and a camera system. The ergonomics of surgery have also changed. Digital theatres dedicated for MIS have been designed and developed. We will be presenting our experience with planning and benefits of new digital theatres at the Red Cross War Memorial Children's Hospital.

Initial planning started with consulting each surgical specialty and trade industry providing digital theatre solutions. Overseas centres with digital operating rooms were visited. There is limited information regarding the ergonomically correct positioning of specialised equipment, anaesthetic pendants and monitors. Each surgical specialty had unique requirements regarding pendant positioning.

As the surgeon is required to perform the surgery looking at the monitor, a good-quality image is vital for better outcomes. We have compared different camera systems to achieve the best image. High-definition systems clearly had advantages over the others.

Digitalisation with full integration of the operating room environment, including surgical equipment and image recording devices controlled by a single-touch screen, minimise the time delays in surgery. Availability of recording of images and video enhanced the data collection for future academic research and presentations. Linking of digital theatres to the lecture room has been another great advantage. Training of surgeons and other medical specialties on new skills has been made possible using live surgery.

In conclusion, digital theatres improved the ergonomic design of operating rooms, provided an excellent work environment for MIS, simplified recording of images and made distant teaching using video conferencing facilities possible.

A SIMPLE METHOD OF CLOSING LAPAROSCOPIC PORT SITE WOUNDS

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Background: Trocar site herniation is a potentially serious complication of laparoscopic surgery. Closure of these ports can be difficult.

Method: Review of our experience with a simple technique of port closure with Ethilon suture (1) with a 31 mm needle without using any special instruments. (Detailed technique will be presented.)

Result: This port closure technique was used in 18 patients who underwent laparoscopic surgery. The follow-up period was from 6 to 12 months; no port site complications were encountered.

Conclusion: Our experience has shown that this simple method of port closure is effective and does not require any special instruments.

LAPAROSCOPIC CHOLECYSTECTOMY IN CUBA – ACHIEVEMENTS AND CHALLENGES: RESULTS OF A MULTICENTRE SURVEY

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On February 1991 the first laparoscopic cholecystectomy (LC) was

done in Cuba. In order to know the results generated with that technique, a survey completed by 17 academic hospitals around the country was done. Data related to 56 878 LCs performed from the beginning of these activities until 2007 were obtained, being defined according to character (elective or urgent), conversion rate, management of bile duct stones (BDSs), and operative morbidity and mortality.

The laparoscopic approach was used in 80.7%, as an elective procedure in 97.1%, with a rate of conversion of 1.4%, morbidity of 0.58% and mortality of 0.10%. BDS findings were managed predominantly with conversion to open surgery and conventional bile duct exploration, but the number of laparoscopic bile duct explorations is rising. The results of LC in Cuba should be considered excellent, but the use of its advantages must be extended, treating a higher proportion of patients with gallstone-related complications.

BILE DUCT INJURIES: MULTICENTRE SURVEY RESULTS OF 17 288 LAPAROSCOPIC CHOLECYSTECTOMIES

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Despite the obvious advantages of laparoscopic cholecystectomy, the frequency of bile duct injuries has been increased. We investigated bile duct injuries during 17 288 laparoscopic cholecystectomies carried out in 6 academic hospitals in 5 provinces of Cuba. The percentage of lesions was low (0.15%). In 59.2% the diagnosis was made postoperatively, and almost 63% were serious lesions (Strasberg type E).

The repair techniques most commonly used were the biliodigestive derivations, but most lesions diagnosed during the operation were treated with T tubes. Major complications were seen in 25.9%. Postoperative bile duct stenosis was mainly related to poor choice of primary repair technique.

THE SPECTRUM OF DIAPHRAGM INJURY IN A BUSY GENERAL SURGICAL SERVICE IN SOUTH AFRICA

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Introduction: The diaphragm may be injured by penetrating or blunt trauma. If injury is not recognised and dealt with there is a risk of significant late morbidity. It may be difficult to establish the presence of diaphragmatic breach or hernia, and a degree of confusion may be associated with recognition and diagnosis of this condition. This prospective study reviews our experience with diaphragmatic injury in a busy general surgical service with a heavy trauma burden.

Methodology: A prospective trauma database is maintained by the general surgical service of the Pietermaritzburg metropolitan complex. All patients who sustained a diaphragmatic injury between September 2006 and September 2007 were included in this study.

Results: A total of 37 patients had diaphragmatic breach confirmed at laparotomy or laparoscopy. The average age was 29 years. The mechanism of injury was stab (24), gunshot wound (10), shotgun (1) and blunt trauma (2). There were 7 deaths in this group. Four patients required a subsequent thoracotomy to deal with lung sepsis and 2 patients required a thoracoscopy to

deal with residual collections. A total of 5 diaphragmatic injuries were diagnosed at laparoscopy. The indication for laparoscopy was proximity stab with a soft abdomen in all cases. Of these injuries 4 were repaired as an open procedure and 1 was repaired laparoscopically.

A total of 11 patients presented with an acute diaphragmatic hernia. The average age was 29. The mechanism of injury was stab (5), gunshot (1) and blunt trauma (5). The hernia contents were colon (1), stomach (7) and spleen (1). The operative approach was a laparotomy (8) and a thoraco-laparotomy (1). A single patient required re-operation because his repair broke down and he re-herniated. In 3 cases there had been inappropriate cannulation of the left chest. There were 2 gastric perforations caused by chest drain placement and the third drain had passed through the diaphragmatic defect into the abdominal cavity. One of these patients required a delayed thoracotomy to deal with chronic pulmonary sepsis. A total of 6 patients presented with a chronic diaphragmatic hernia of longer than 6 months' duration. The average age was 29.9 years and the mechanism of injury was stab (4), blunt trauma (2) and gunshot wound (1). The average delay from injury to presentation was 3.5 years. The contents were colon (3) and stomach (3). All these chronic hernias were repaired at laparotomy.

Conclusion: If there is an established indication for laparotomy, diaphragmatic breach is usually recognised and dealt with appropriately. Failure to follow principles may result in a diaphragmatic injury being overlooked. Isolated diaphragmatic injury without associated visceral injury cannot be diagnosed clinically or radiologically. Direct video-endoscopic inspection absolutely confirms or refutes the diagnosis of diaphragmatic breach. Diaphragmatic herniation can present acutely after trauma or at a time remote from the original trauma. Acute diaphragmatic injury may be confusing to treating physicians and there is a real risk of inappropriate interventions being undertaken. Most diaphragmatic hernias can be dealt with via a trans-abdominal route.

LAPAROTOMY FOR BLUNT TRAUMA IN PIETERMARITZBURG

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Introduction: This report looks at the spectrum of major blunt torso trauma that presents to a busy metropolitan tertiary trauma service in South Africa

Methods: A prospective trauma registry is maintained by the surgical services of the Pietermaritzburg metropolitan complex. This registry was interrogated retrospectively. All patients who required admission for blunt torso trauma over the period September 2006 - September 2007 were included for review. Proformas documenting: mechanism of injury, age, vital signs, blood gas, delay in presentation, length of hospital stay, ICU stay and operative details were filled.

Results: A total of 926 patients were treated for blunt trauma by the Pietermaritzburg metropolitan services during the period under consideration. A cohort of 65 (8%) required a laparotomy for blunt trauma during this period. There were 17 females in this group. The mechanism of injury was MVA (27), PVA (21), assault (5), fall from height (3), bicycle accident (6), quad bike accident

(1) and tractor-related accident (2). The following isolated injuries were discovered at laparotomy: liver (9), spleen (5), diaphragm (1), duodenum (2), small bowel (8), mesentery (8) bladder (10), gallbladder (1), stomach (2), colorectal (2) and retrohepatic vena cava (1). The following combined injuries were discovered: liver and diaphragm (2), spleen and pancreas (1), spleen and liver (2), spleen and aorta and diaphragm (1), spleen and bladder (1) and small bowel and bladder (2). There were 18 (26%) patients who required re-laparotomy in this series. In ten patients Bogota bag closure was needed. The mortality was 18 (26%). There were 6 deaths from massive bleeding, all within 6 hours of operation. There were 3 deaths from renal failure and the remaining 9 died of multiple organ failure. There were 8 (7%) negative laparotomies. In the negative laparotomy group false-positive CT scan findings were a problem in 3. In 1 case hypotension and a fractured pelvis on admission prompted laparotomy, and in the other patients clinical findings prompted laparotomy. All patients undergoing negative laparotomy survived. There were 10 pelvic fractures, 5 lower limb fractures, 2 spinal injuries, 4 femur fractures and 2 upper limb fractures. A computed tomography (CT) scan was done in 25 patients. In 20 the systolic blood pressure on presentation was <90 mmHg, and in 41 the pulse rate was >110. In 16 patients there was a base excess of <-4 on presentation.

Conclusion: There is a high volume of significant blunt trauma in Pietermaritzburg. The ratio of hollow visceral to solid visceral trauma is different to that reported in the literature. CT scanning is very accurate in predicting intra-abdominal injury and influenced management decisions significantly. Managing significant blunt trauma without liberal use of radiological imaging is inappropriate.

ONE HUNDRED AND EIGHT EMERGENCY OPERATIONS FOR PENETRATING THORACIC TRAUMA

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Introduction: Penetrating thoracic trauma can usually be managed non-operatively. In a subset of patients emergency surgical intervention is necessary. This audit examines our experience with emergency operation for thoracic trauma in a busy metropolitan surgical service.

Methodology: A prospective trauma registry is maintained by the Pietermaritzburg metropolitan complex. This database was retrospectively interrogated for all patients requiring an emergency thoracic operation for penetrating injury from July 2006 to July 2009. A retrospective review of mortuary data for the same period was undertaken to identify patients with penetrating thoracic trauma who had presented to the forensic mortuary.

Results: Over the 3-year period July 2006 - July 2009, a total of 1 186 patients, 77 of whom were female, were admitted to the surgical services in Pietermaritzburg with penetrating thoracic trauma. There were 124 gunshot wounds (GSWs) and 1 062 stab wounds. A total of 108 (9%) patients required emergency operation during the period under review. The mechanism of trauma in the operative group was stab wounds (102), GSWs (4), stab with compass (1) and fell on arrow (1). Over the same period 676 victims of penetrating thoracic trauma were taken to the mortuary. There were 135 GSWs (20%) of the chest in the mortuary cohort. Of the 541 stab wound victims from the mortuary cohort, there were 206 (38%) with cardiac injuries. In the emergency operation

group there were 11 (10%) deaths. In 76 patients a cardiac injury was identified. The other injuries identified were lung parenchyma bleeding (12) intercostal vessels (10), great vessels of the chest (6), internal mammary vessel (2), and pericardial injury with no myocardial injury (2). Most patients reached hospital within 60 minutes of sustaining their injury. A subset of 12 patients had much longer delays of 12 - 24 hours. Surgical access was via median sternotomy in 56 patients and lateral thoracotomy in 52.

Conclusion: Less than a quarter of patients with a penetrating cardiac injury reach hospital alive. Of those who do and are operated on, about 90% will survive. Other injuries necessitating emergency operation are lung parenchyma, intercostal vessels and internal mammary vessels and great vessels of the thorax. GSWs of the thorax remain more lethal than stab wounds.

VARIATIONS IN THE LEVEL OF CARE OF PROVIDED WITHIN A HOSPITAL TO ACUTE TRAUMA PATIENTS DURING THE FIRST 24 HOURS FOLLOWING ADMISSION

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Introduction: Caring for trauma patients is a dynamic process, and it is often necessary to move the trauma patient around the hospital to different locations. This study attempts to document the quality of observations performed on acute trauma patients as they move through the hospital during the first 24 hours of care.

Methodology: This study was a student elective and was undertaken at Grey's Hospital in Pietermaritzburg. A third-year medical student was assigned to follow acute trauma patients throughout the hospital during the first 24 hours following admission. This single independent observer recorded the frequency with which vital signs were recorded at each geographical location in the hospital for each acute trauma patient. A scoring system was devised to classify the quality of the observations that each patient received in the different departments. The observer recorded all the geographic movements each patient made during the first 24 hours of admission.

Results: Fifteen patients were recruited into this study over a 4-week period. There were 14 adult males (average age 28 years range 18 - 56) and a 7-year-old girl in the cohort. There was great variability in the quality of the observations each patient received during the first 24 hours in our institution. There were significant differences in the quality of the observations depending on the geographical location in the hospital. These variations and differences were consistent in certain locations and highly variable in others. There uniformly excellent observations were delivered in the ICU and the operating theatre. In the radiology suites the level of observations was universally poor. In casualty and the wards there was great variability of the level of observation. There were a total of 45 distinct geographical patient visits in the study cohort. Each patient made an average of 3 (range 2 - 5) distinct geographical visits during their first 24 hours after admission. All patients attended casualty. There were 11 patient visits to the ward, 10 to radiology, 4 to ICU and 5 to theatre.

Conclusion: Significant variations exist in the level of observations of vital signs between different geographical locations within the hospital. This is problematic as acute trauma patients need to be moved around the hospital as part of their routine care. If observations are not done and acted upon, subtle clinical

deterioration may be overlooked and overt deterioration may be heralded with a catastrophic event.

A PROSPECTIVE STUDY OF ACUTE SERUM AMYLASE LEVELS FOLLOWING BLUNT ABDOMINAL TRAUMA

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Introduction: Some protocols advise the routine use of serum amylase levels in the assessment of blunt abdominal trauma. This prospective pilot study looks at the spectrum of serum amylase levels in patients following blunt abdominal trauma and correlates the levels with the clinical outcome.

Methodology: This was a prospective study. All patients presenting with blunt abdominal trauma from November 2010 had routine serum amylase measured on admission to the accident and emergency unit (AE). Standard demographic data were recorded as well as mechanism of injury, clinical findings, computed tomography (CT) or abdominal ultrasound findings as well as operative findings and or clinical outcome.

Results: Thirteen patients were enrolled. There were 7 female patients with an age range of 19 - 34 years and 6 male patients with an age range of 9 - 64 years. Five patients were drivers in RTAs. Two patients were pedestrians. One patient fell onto an iron bar, 1 fell onto a rock and 1 was struck by a football in the abdomen. The remainder were assaulted and sustained kicks and punches to the abdomen. All but 1 patient had a raised serum amylase. The mean amylase level was 216 ug/ml, range 100 - 3 042. One patient had a pancreatic laceration demonstrated on CT (serum amylase 340). Two patients underwent negative laparotomy. One patient died in the AE. The remaining 9 patients were discharged well after a period of in-hospital observation. The average length of stay was 1.5 days. The longest stay was 4 days.

Conclusion: This small pilot study reveals that amylase levels are often elevated following blunt abdominal trauma. The clinical significance of an elevated serum amylase level is unclear. More patients need to be enrolled to establish the clinical significance, if any, of a mildly elevated serum amylase level following blunt abdominal trauma.

APPLYING MODERN ERROR THEORY TO THE PROBLEM OF MISSED INJURIES IN TRAUMA

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Background: Modern theory of human error has helped reduce the incidence of adverse events in commercial aviation. It remains unclear whether these lessons are applicable to adverse events in trauma surgery. Missed injuries in a large metropolitan surgical service were prospectively audited and analysed using a modern error taxonomy to define its applicability to trauma.

Methods: A prospective database of all patients who experienced a missed injury during a 6-month period in a busy surgical service was maintained from July 2006. A missed injury was defined as one that escaped detection from primary assessment to operative exploration. Each missed injury was recorded and categorised. The clinical significance of the error and the level of physician responsible were documented. Errors were divided into planning or execution errors, acts of omission or commission, or violations, slips and lapses.

Results: A total of 1 024 trauma patients were treated by the surgical services over the 6-month period from July to December 2006 in Pietermaritzburg. Thirty-four patients (2.5%) with missed injuries were identified during this period. There were 29 men and 5 women, with an average age of 29 years (range 21 - 67 years). In 14 patients, errors were related to inadequate clinical assessment. In 11 patients errors involved the misinterpretation of, or failure to respond to radiological imaging. There were 9 cases in which an injury was missed during surgical exploration. Overall mortality was 27% (9 patients). In 5 cases death was directly attributable to the missed injury. The level of the physicians making the error was consultant surgeon (4 cases), resident in training (15 cases), career medical officer (2 cases), referring doctor (6 cases).

Conclusions: Missed injuries are uncommon and are made by all grades of staff. They are associated with increased morbidity and mortality. Understanding the pattern of these errors may help in developing error reduction strategies. Current taxonomies help in understanding the error process, but efforts must be made to develop innovative mechanisms that reduce the potential for error.

THE MANAGEMENT OF BURNS BY THE GENERAL SURGEON

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Abundant data have confirmed that severe burns (defined as deep dermal or full-thickness burns involving 10% or more of the total body surface area in children and 15% or more of the total body surface area in adults) are best managed in burn centres. In South Africa these centres are limited to academic hospitals, with very strict admission criteria and few beds. There is only one private burn centre, situated at Milpark Hospital in Gauteng. Around the world the number of available burn unit beds is shrinking. This has occurred because of the high cost and relatively poor reimbursement associated with the provision of burn care. Because there are fewer burn care beds, there is a significant risk that transfer of a severe burn injury will be delayed because of bed availability and distance from the burn injury location and burn centre. Experience reported from civilian burn units and military burn units caring for patients injured in Iraq and Afghanistan indicates that initial care of burn injuries is often associated with inaccurate assessment of the extent of injury. This inaccurate assessment leads to an increase in overall complication rates, particularly complications of resuscitation. Because of these facts, it is important that general surgeons, who will likely be called upon to provide the initial management and most often the total management of burn injury, familiarise themselves with the fundamentals and most recent options of early burn management.

The presentation intends to supply information required by general surgeons so that safe, early burn care can be provided.

Death from burn injury depends on the extent and depth of burn, the age of the patient, and the presence of inhalation injury. Intravenous fluid resuscitation is indicated when deep dermal and full-thickness burns involve more than 15% of the body surface area in adults and 10% of the body surface area in children. The presence of inhalation injury is an indication for fluid resuscitation. Prompt resuscitation is important because of data cited by Latenser indicating an increase in burn mortality if resuscitation is delayed more than 2 hours from the time of injury. The traditional endpoints of mean arterial pressure ≥ 70 mmHg and urine output of 0.5 - 1 ml/kg/h have been validated using sophisticated assessments of central haemodynamics in two recent reports. Recent focus on the complications of fluid resuscitation has been on the perceived increase in morbidity due to intra-abdominal hypertension and extremity compartment syndromes. These complications are linked to increased administration of electrolyte solutions.

Severe thermal injury ($>40\%$ TBSA) is followed by a pronounced hypermetabolic response that persists for up to 2 years after the burn. Numerous therapeutic strategies to modify this response have arisen and include early excision and grafting, thermoregulation, early continuous enteral feeding (high carbohydrate/high protein), the use of anabolic agents, growth hormone, IGF-1, IGFBP-3, insulin, oxandrolone, propranolol and the use of therapeutic exercise.

A wide variety of topical agents is available and has an influence on the healing of the burn wound. Topical antimicrobial agents play a different role today than they did in the past. Each type of burn wound should have a different management strategy. Excision of the burn wound within 24 hours after the burn is associated with decreased bleeding, a significantly shorter length of hospitalisation and fewer operations, but no difference in mortality (long-term morbidity has not been evaluated). Immediate cover with autologous skin grafts produces rapid, permanent and satisfactory wound closure. A host of biological and synthetic skin substitutes have been developed for temporary coverage where auto-grafting is impossible or unlikely to succeed.

Pain is an important feature of the acute and chronic care of burn injuries. Pain may be the result of the injury itself and/or the procedures necessary to treat the injury. Barriers to effective pain control include caregiver concerns regarding respiratory depression and hypotension in the acute phase of burn management. Later in the patient's course, a barrier to effective pain control is the failure to understand the difference between opioid tolerance and addiction.

The author will conclude by presenting his institution's protocol.