Methods: Aspiration of the IM cavities of 5 patients' femurs with matched ICBMA was performed. The long-bone-fatty-bone-marrow (LBFBM) aspirated was filtered (70 μm) and the solid fraction digested for 60 min (37 °C) with collagenase. MSCs were isolated from LBFBM-liquid/LBFBM-solid fractions and from matched ICBMA. Enumeration of MSCs was achieved via colony-forming-unit-fibroblast (CFU-F) assay and flow-cytometry on fresh sample using $CD45^{low}$ $CD271^{+}$. MSCs were cultured by virtue of their plastic adherence and passaged in standard, non-haematopoietic media. Passaged (P2) cells were differentiated towards osteogenic, adipogenic and chondrogenic lineages with their phenotype assessed using flow-cytometry CD33, CD34, CD45, CD73, CD90, CD105.

Results: MSCs were isolated from all fractions. Using the CFU-F assay median number of colonies: ICBMA = 8 (2–21), LBFBM-liquid = 14 (0–53), LBFBM-solid = 116 (23–171) per 200 μl of sample with MSC frequency, as percentage of total cells, using flow-cytometry, providing similar results. MSCs isolated from the LBFBM phases appeared to be not inferior to ICBMA in terms of osteogenic, chondrogenic or adipogenic differentiation. Passaged cells from all fractions had a phenotype consistent with other reported sources.

Discussion: The IM cavity of the femur is a depot of MSCs which are closely associated with fat but are at least equivalent to ICBMA in terms of osteogenic/chondrogenic differentiation. Intramedullary cavities of long-bones are frequently accessed by the orthopaedic/trauma surgeon and reaming/removal of IM contents is necessary for the nailing/insertion of prostheses. Removal of the LBFBM prior to standard reaming, using a syringe and suction tubing, is a 'low-tech' method of harvesting LBFBM that can be briefly digested to give high yields of MSC. The volumetric concentration of MSCs within this fraction is significantly higher than that for ICBM (~10 fold) and we postulate that this would aid its use as an alternative for autologous/allogenous use.

Conclusion: High concentrations of MSC can be achieved by brief digestion of aspirated IM fat from the femur. These cells appear appropriate for orthopaedic applications.

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1A.59

The reamer–irrigator–asiprator (RIA): a systematic review

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Background: The 'reamer–irrigator–aspirator' (RIA) is an innovation developed to reduce fat embolism (FE) and thermal necrosis (TN) that can occur during reaming/nailing of long-bone fractures. Since its inception its indications have expanded to include the treatment of post-operative osteomyelitis and as a harvester of bone-graft/mesenchymal-stem-cells (MSCs).

Purpose: To review the sources reporting on this device and comment on its effectiveness to (1) prevent FE and TN; (2) treat post-operative osteomyelitis; (3) harvest bone-graft and MSCs; and (4) operate safely.

Methods: A systematic review via pubmed and google scholar using the keywords 'reamer', 'irrigator' and 'aspirator'.

Results: Experimental data supports the use of the RIA in preventing FE and TN, however, there is a paucity of clinical data. The RIA is a reliable method in achieving high volumes of bone-graft and MSCs. High union rates are reported when using RIA bone-fragments to treat non-unions, however, papers are subject to confounding factors. Evidence suggests possible effectiveness in treating post-operative ostemyelitis. The RIA appears safe, with a low rate of morbidity provided a meticulous technique is used.

Conclusions: Current evidence suggests that the RIA is safe to use and effective in (1) preventing FE and TN; (2) treating post-operative osteomyelitis; (3) harvesting bone-graft and MSCs. This RIA demands further investigation especially with respect to the optimal application of MSCs for bone repair strategies.

Conflict of interest: The authors declare that there is no conflict of interest.

Ethical statement: Not applicable.

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1A.60

Comparing the prognostic performance of S100B with prognostic models in traumatic brain injury

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Introduction: There are currently two prognostic tools available for predicting outcome in traumatic brain injury (TBI). The first involves prognostic models combining clinico-demographic characteristics of patients for outcome prediction, whilst the second employs serum brain injury biomarkers. S100B is a widely acknowledged biomarker of brain injury.

Objective: To identify which method has better prognostic strength and explore how combining these methods might improve the prognostic strength.

Methods: We analysed data from 100 TBI patients, all of whom were admitted to the intensive care unit and had venous S100B levels recorded at 24-h after injury. TBI prognostic models A and B, constructed in Trauma Audit and Research Network (TARN), were run on the dataset and then S100B was added as an independent predictor to each model. Furthermore, another model was developed containing only S100B and subsequently, other important TBI predictors were added to assess their ability to enhance the predictive power of this model. The outcome measures were survival and favourable outcome at 3 months.

Results: Among all the prognostic variables (including age, cause of injury, GCS, pupillary reactivity, Injury Severity Score (ISS) and CT classifications); S100B has the highest predictive strength on multivariate analysis. No difference between performance of prognostic models or S100B in isolation was observed. Addition of S100B to the prognostic models improves the performance (e.g. Area Under

the roc Curve (AUC), R^2 Nagelkerke and classification accuracy of TARN model A to predict survival increase from 0.64, 0.08 and 71% to 0.72, 0.20 and 74.7%, respectively). Similarly, the predictive power of S100B increases by adding other predictors to S100B (e.g. AUC (0.69 versus 0.78), R^2 Nagelkerke (0.15 versus 0.30) and classification accuracy (73% versus 77%) for survival prediction).

Conclusion: S100B appears to be the strongest prognostic variable in TBI. A better prognostic tool than those which are currently available may be a combination of both clinic-demographic predictors with S100B.

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1A.61

Massive blood transfusion practice in United Kingdom trauma

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Introduction: Haemorrhage is a leading cause of mortality in trauma, with recent evidence emphasising the importance of haemostatic resuscitation and use of massive transfusion protocols. Few studies have characterised massive blood transfusion (MBT) practice in United Kingdom (UK) trauma. This study describes the Trauma Research and Audit Network (TARN) experience of massive transfusion over a 5-year period.

Methods: We analysed prospectively collected data from the TARN database for patients presenting between 2005 and 2009. MBT was defined as administration of 10 or more units of packed red cells within 24 h. The prevalence of MBT was examined, and patient characteristics, blood product usage and mortality compared to non-MBT patients. Initial clinical and injury features predictive of massive transfusion and risk factors predictive of death in MBT were also analysed using multivariate logistic regression.

Results: One hundred and fifty seven (0.4%) received MBT, with a mortality rate of 40.3%. Median age of MBT patients was 39.5 years, median ISS was 27 and 78% were male. MBT patients were more likely to be younger, male and to have sustained more severe, penetrating or trunk trauma ($p < 0.01$). No patients received platelets and FFP in 1:1 ratios with packed red cells. Multivariate analysis showed: age OR 1.02 (1.005–1.025), admission pulse rate OR 1.02 (1.016–1.029), systolic blood pressure OR 0.96 (0.969–0.981), and injury type; thoracic OR 4.21 (2.706–6.536), abdominal OR 5.06 (3.253–7.88), pelvis OR 3.649 (2.02–6.591), were significant predictors of MBT. ISS and admission pulse rate were also independent predictors of death in MBT, but level of platelet and FFP use were not found to be statistically significant.

Conclusion: MBT is a rare event with high mortality in UK trauma. Haemostatic resuscitation is not currently practiced in the UK and we were unable to show that FFP and platelet use were significant predictors of survival in MBT.

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1A.62

Comparing model performance for outcome prediction using total GCS and its components in traumatic brain injury

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Objective: To analyse the prognostic power of various GCS components and combinations of components in traumatic brain injury patients and to investigate which time point of GCS measurement (at scene versus on admission to the Emergency Department (ED)) has more prognostic strength.

Methods: Records of patients with brain injury since 1989 were extracted from the Trauma Audit and Research Network (TARN) database. Using logistic regression, a baseline model was derived with age and Injury Severity Score (ISS) as regressors and discharge outcome (survival) as the dependent variable. Total GCS, its components and their combinations were separately added to the baseline model in order to compare their effect on model performance.

Results: 21454 cases with brain injury were analysed. The eye subscore has significantly lower performance compared to total GCS, motor score and various combinations of GCS subscores [e.g. eye subscore: AUC of 0.89 (95% CI: 0.89–0.90) and Nagelkerke R^2 of 0.53, total GCS: AUC of 0.91(95% CI: 0.91–0.92) and Nagelkerke R^2 of 0.58]. The total GCS and the motor subscore have the same predictive strength. Furthermore, the total GCS score at scene and its components hold significantly lower predictive power as compared to those recorded on arrival at ED [scene total GCS: AUC: 0.89(95% CI: 0.89–0.90) and Nagelkerke R^2 of 0.54, arrival total GCS: AUC of 0.91 (95% CI: 0.91–0.92) and Nagelkerke R^2 of 0.58].

Conclusion: Significantly lower predicative performance of the eye subscore may indicate the need for a surrogate scale when collection of both motor and verbal response is not reliable due to paralysis and intubation. Further, better predicative strength of admission scores than scene scores may be due to less accurate measurement of GCS at scene. This highlights the importance of initiatives to improve GCS collection at scene since GCS affects critical decisions as to field endotracheal intubation or triage for referral to the trauma centres.

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1A.63

Major incident tabletop exercises: a high tech, low cost evolution

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Traditional tabletop exercises, that facilitate major incident (MI) planning and education, use paper plans and models. We describe a low-cost, electronic whiteboard that explores how interactive soft-