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Improving cranial ultrasound scanning strategy in neonates

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Abstract

Cranial ultrasound scans are undertaken in this tertiary neonatal intensive care unit by the doctors within the department. A quality improvement project was undertaken by means of two PDSA cycles to determine adherence to neonatal cranial ultrasound scanning schedule, assess the quality of scan reporting, and formulate a comprehensive guideline outlining best practice. The baseline measurements assessed 93 scans of preterm infants and 9 of term infants. The results of this prompted intradepartmental education (PDSA cycle 1) then creation and implementation of a documentation template, a local guideline, and education via presentations, posters, and email (PDSA cycle 2). These encompassed 77 preterm and 5 term scans. In our baseline measurements, 52% of preterm infant scans and 44% of term infant scans were performed to schedule. Of premature baby scan reports, 75% had the time documented and 92% the name of the scanning doctor. After implementing changes PDSA cycle 2 data showed that 74% of preterm infant scans and all term infant scans were performed according to schedule, with 100% having the doctor's name and time of scan documented.

We successfully introduced a guideline and documentation template, improving performance to schedule and documentation in most areas. It remains an ongoing challenge to adhere to basic standards of documentation; a template can assist in achieving this. Rotating trainees may offer insight into areas that could benefit from quality improvement. This enthusiasm can be successfully harnessed to implement changes to improve quality of patient care.

Problem

An opportunity to improve timing and documentation was identified by specialist trainee paediatric registrars in the Neonatal Intensive Care Unit, Queen Alexandra Hospital in Portsmouth, England who form part of the scanning service along with neonatal consultants and Advanced Neonatal Nurse Practitioners (ANNPs). It was identified during ward rounds that there were inadequacies in the documentation and reporting of the cranial ultrasound scans undertaken on the unit, and inconsistency in when scans were undertaken with no documented schedule to adhere to.

We therefore set out to analyse the problem via a completed audit, and implement changes to address the problems found. The aim of this project is to improve documentation and reporting of cranial ultrasound scans on the unit, and provide a clear structure to rotating trainees.

Background

Cranial ultrasound scanning is used as a screening tool for identification and monitoring of pathology in infants admitted to neonatal units. Doctors and ANNPs provide the scanning service, screening those known to be at risk of having or developing intracranial pathology. This includes premature infants who are at risk of intraventricular haemorrhage (IVH), hydrocephalus, and cystic periventricular leucomalacia (PVL). Term babies who have suffered hypoxic ischaemic encephalopathy (HIE) and who demonstrate abnormal neurology e.g. seizures are also scanned. Cranial ultrasound may additionally be utilised in infants with antenatally-detected brain abnormalities, in infants with midline defects or micro/macrocephaly, or where there is a history of maternal use of cocaine, ecstasy, or methamphetamine during pregnancy.

Serial cranial ultrasound scanning is used for monitoring in diagnosed conditions such as IVH, hydrocephalus, and PVL. These findings have been shown to effect neurodevelopmental outcome as described by Perlman in 1998, and perceived quality of life in adolescents as described by Feingold et al in 2002.

Baseline measurement

The audit was designed to quantify documentation/note keeping looking separately at term and preterm data. Baseline measurements were collected from all scans in all inpatient notes between September 2013 and February 2014, encompassing 93 preterm and 9 term scans, auditing when and why the scans were undertaken and specific details pertaining to documentation of the scan report. This included the date, time of scan being done, corrected gestational age of the baby, name of the scanning practitioner, a signature, if a consultant had reviewed the images (live or images printed), and if the scan had been performed to the consultants agreed schedule. Cranial ultrasound scans were recorded as free text on a proforma along with other radiographs/scans undertaken in the patients' notes.

From this data it was evident that there were varying time intervals between scans on patients, with few having a documented plan as to when the next scan was due. Essential documentation was disappointing, including the date/time of the scan (although this information is available on the printed out scan images), gestation of the baby, and a legible name of the scanning doctor. We

identified a need to standardise the scanning process and documentation in order to provide a consistently high quality service. The results were presented at our departmental audit meeting in February 2014. The expected standard is that 100% of infants should be scanned according to the anticipated schedule, and that 100% of the key areas audited should have been completed in the notes.

See column labelled Baseline 2013/2014 data in the results table.

See supplementary file: ds7062.docx - “Standards for Cranial Ultrasound Strategy”

Design

This quality improvement project consisted of two PDSA cycles.

PDSA 1 was undertaken in the beginning of December 2014. Here the baseline results were presented as part of our departmental audit meeting in February 2014 as part of an educational intervention. Recommendations from the audit meeting included quantifying those who had a date or documented plan for when the next scan was due, and to extend the description of image results to include comments on parenchyma, cystic changes, or periventricular brightness. These were added on to the data collection proforma accordingly and correlates to the Badger data documentation. It was also recommended that a documentation template be created to facilitate documentation in the patient notes.

PDSA cycle 2 was undertaken at the end of January 2015. Changes in practice implemented in PDSA cycle 2 were as follows:

- Production of a comprehensive guideline agreed amongst the consultant body. Electronic copies were distributed via email and made available on the hospital intranet. Hard copies were placed in the departmental guideline folder and on the scanning machine.

- Introduction of a documentation template to go into patient notes (Figure1:Documentation Template). It was agreed that the documentation template would be placed into every set of notes in the radiology reporting section which already existed for our pre-made notes. It was also placed in the documentation trolley for those already on the unit or who needed subsequent pages adding. This means it is a sustainable change, and one which has now been in use for over a year.

- Education of medical staff via posters displayed in relevant areas of the department, summarising the guideline and demonstrating the new documentation template, and via a ‘One Minute Wonder’ board in the blood gas analysis room.

Locally-agreed standards for neonatal ultrasound reporting include that there should be specific comments on if the scan is normal or not, the presence or absence of IVH, cysts, and if the parenchyma is normal. Presence of ventricular dilatation should be noted, and if considered to be significant, measurement of ventricular index should be undertaken and documented. If a specific additional measurement such as a Resistance Index has been done this should be commented upon. Lastly there should be a mention of whether the scan was performed under supervision, or reviewed by a consultant and when the next scan is due (please see Figure 2: Documentation Template).

Strategy

Baseline Measurements 2013/2014.

PDSA cycle 1. The aim was to improve our documentation via educational intervention at the audit meeting in 2014. We used an updated data collection proforma following this meeting to capture more data. We hoped that there would be an improvement in documentation and scanning schedule adherence following this intradepartmental education. Measured to see impact (labelled PDSA 1 on results table). We demonstrated no real improvements and so decided to implement further changes.

PDSA cycle 2. The aim was to further improve our documentation via the creation of a documentation template placed into every set of notes, a cranial ultrasound scanning guideline placed on the scanner itself and in the guidelines folder, further education via emails and a poster on our departmental one minute wonder board and in the staff office. Measured to see impact (labelled PDSA 2 on results table). We demonstrated great improvement in most areas following these changes.

See supplementary file: ds7061.docx - “Documentation Template”

Results

Throughout the audit the cranial ultrasound scans were undertaken by all grades of doctors and ANNPs. The majority were undertaken by consultants and Year 4 Specialty Training Registrars (STR4) in both the premature and term groups, the rest were undertaken by STRs years 1,3,5, and 6. In the baseline data (2013/14) for premature scans consultants scanned 29% and STR4s scanned 27%. In the term data during baseline measurements consultants scanned 44% and STR4s 22%. In the 2014/15 impact measurements for premature data consultants scanned 33% in PDSA cycle 1, and 26% in PDSA cycle 2. In the term data of PDSA cycle 2 consultants scanned 40% and STR4 the remaining 60%.

The 2013/14 audit data demonstrated that 40% of the preterm infant scans and 67% of the term infant scans were reported as ‘normal for gestation’. There was no comment made on the presence of absence of IVH in 16% of preterm infant scans and 11% of term infant scans. Ventricular dilatation was commented upon in 6% of the preterm infant scans and none of the term infant scans. There was no comment made of the presence or absence of ventricular dilatation in 66% of preterm infant scans and 56% of term infant scans.

PDSA cycle 1 (with only premature infant scan data because no term infants required scanning during this period) showed that 90% of scan reports were documented as “normal for gestation”, 56% had no documentation on IVH, 56% with no documentation on

ventricular dilatation, and 18% with no documentation on parenchyma. Ventricular brightness was documented in 10% of premature infant scans. No cysts were seen. There was no comment on when the next scan was due in 97% of the reports.

PDSA cycle 2 demonstrated great improvements in documentation. Preterm data showed 95% of scans being reported as “normal”, 100% documentation on IVH, 3% had non-specific comments mentioning abnormalities of ventricular size, 3% had dilatation with VI measurements, all commented on parenchyma with 3% showing cystic changes. Term data showed complete documentation of normal scans clarifying absence of IVH and ventricular dilatation. All commented on parenchyma, with 20% showing periventricular brightness. There was no comment on when the next scan was due in 37% premature scans and 20% term scans on the data collected. Please see Tables for detailed results.

See supplementary file: ds7060.doc - “Results table to show scan documentation”

Lessons and limitations

There are times when the clinical picture may indicate a scan is required outside of the proposed schedule, however this did not account for any of the deviations from the expected standard of practice captured during our auditing cycles. We feel the findings are generalisable and applicable to other neonatal departments which run their own cranial ultrasound scanning service and have large numbers of preterm infant admissions.

We had a small amount of term data compared to our preterm data, which could have been expanded by lengthening the audit period. With increased use of early MRI scans for term babies having suffered a hypoxic injury perinatally, it is anticipated the number of cranial ultrasounds undertaken in this group may fall over time.

During our baseline measurements we did not collect data with regard to bleep numbers, day of life, documentation on when the next scan was due, periventricular brightness, or cystic changes. These were added to the proforma following the 2014 audit meeting presentation and after standards were agreed for the guideline for PDSA cycles 1 and 2.

We have found that documentation remains suboptimal in the areas of documenting when the next scan is due and consultant review of images. Our signature rates dropped dramatically because the template for scan reporting did not incorporate a space for a signature. The template itself is a cost effective and sustainable tool. Action taken to sustain this improvement include making the documentation template an integral part of every set of new patient notes created by our ward clerks. The team of consultants on the unit use it on every ward round, and so it is anticipated that sustainability should not be a limitation in the long run. It might however be realistic to acknowledge that versions of it will appear over time as ways to improve it further may be found. The latest in use version has a signature area, how many scanned images had been stored, and how many had been printed as additions from the original template.

Documentation in patient notes is an important tool, not only for immediate communication but also in the long term. In 2013/14 the NHS paid £1,051,173 compensation to patients who suffered clinical negligence. Rosenbloom reports that 'the greatest single proportion of this is paid as compensation to successful claimants in brain damage at birth litigation'. Many claimants will have passed through the doors of a neonatal unit, and many will have had at least one CrUSS which may be used as evidence in court. The General Medical Council provides clear guidance for standards of documentation.

Creating a guideline and documentation template successfully led to improvements in performing scans to schedule and documentation in most fields. Medico-legally the template provides clear evidence as to who undertook the scan, when it was done, what was found, and if a consultant reviewed it. It does not replace an entry in the notes for any action taken as a result of the scan findings, and what was communicated to the parents of the infant.

Conclusion

This quality improvement project led to an improvement in service provision relating to neonatal cranial ultrasound by development of a guideline and structured template for scan reporting. This is a sustainable and effective solution to the problem of documentation, and allows easier monitoring of changes on scans over time such as evolution of cystic or haemorrhagic changes and development of hydrocephalus. The introduction of a guideline is also a sustainable tool for allowing rotating junior doctors to maintain adherence to an agreed standard of high quality care in this vulnerable group of patients.

References

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Declaration of interests

This work was presented as a poster at the Royal College of Paediatrics and Child Health Annual meeting in 2015 under the Quality Improvement section.

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Ethical approval

This project was an improvement study and audit registered with our hospital audit department. It was not research and it did not require ethical approval.