Pediatric surgeons’ attitudes toward regionalization of neonatal surgical care

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Background/Purpose: Research has suggested that high-risk pediatric surgical patients have better outcomes when treated in resource-rich children’s environments. Surgical neonates are a particularly high-risk population and some suggest that regionalization might be a strategy to improve clinical outcomes in neonatal surgical patients. We conducted a national survey of pediatric surgeons in the United States to explore their attitudes toward regionalization of neonatal surgical care.

Methods: Members of the American Pediatric Surgical Association were asked to participate in an anonymous online survey to assess both attitudes toward regionalization, as well as perceptions of the importance of various resources in providing optimal care for surgical neonates.

Results: Overall, 56.2% of participants favored regionalization. Surgeons whose practice was part of a training program tended to favor regionalization more, as did those from larger group practices and those who practiced at free-standing children’s hospital. In addition, surgeons from larger groups and those involved with training programs more strongly favored the premise that a higher level of resource commitment should be available to treat surgical neonates.

Conclusions: The impact of any national strategy to improve neonatal surgical outcomes will be large and multifaceted. While the majority of pediatric surgeons favor regionalization, our findings demonstrate variation in this view and highlight the necessity for surgeon involvement and education that will be critical in this effort.

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Neonates are a high-risk surgical population with a mortality rate greater than 13 times that in the overall pediatric surgical population [1]. Surgical neonates have unique comorbidities and require complex procedures demanding a high level of multidisciplinary resources. The specialized resources that surgical neonates need are expensive and it may therefore not be feasible for every hospital that currently treats surgical neonates to provide the full complement of people and other resources.

The concept of treating patients in environments with resources that match their needs is not new. The system for trauma care in the United States is based on this principle. Accredited trauma centers have to undergo periodic verification to demonstrate that they possess the necessary contemporary resources to provide optimal care to the trauma patient, and pediatric trauma patients with significant injuries have been demonstrated to have better outcomes when treated in trauma centers [2,3]. Similar findings have been demonstrated in very low birth weight infants, another high-risk population, whose care in higher level and higher volume neonatal intensive care units has been associated with better outcomes [4,5].

While a move toward concentrating neonatal surgical care has not been definitively supported by data, regionalization is one strategy to ensure that surgical neonates are treated in an environment where resources match their individual needs.

If a transition toward regionalization were to be undertaken in the future, it would be imperative to understand pediatric surgeons’ attitudes towards regionalization of care. In this study, we developed a survey to study pediatric surgeons’ opinions regarding regionalization and obtain their views on the resources thought necessary to provide contemporary optimal care of the surgical neonate.

1. Methods

1.1. Study Population

This study utilized a convenience sample of members of the American Pediatric Surgical Association (APSA) who were currently in

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practice or had previously practiced pediatric surgery in the United States as of March 2012. All 961 full members, candidate members, senior members, and associate members of APSA were eligible to participate. Each surgeon was emailed an invitation from APSA to participate in the survey in March 2012, and provided an internet link to an anonymous electronic web-based survey on the SurveyMonkey website [6].

Of note, there are currently 864 pediatric surgeons certified by the American Board of Surgery (ABS) with a certificate of special competency in pediatric surgery, indicating that the APSA membership is representative of the pediatric surgery community.

1.2. Survey

The survey (Table 1) was developed by two of the authors (LEC and KTO). The survey was designed to include a comprehensive set of issues that regionalization might impact. The survey was vetted for clarity by a focus group comprised of members of the APSA Outcomes & Clinical Trials Committee.

Definitions: Neonatal surgery was defined as intra-cavitary abdominal and non-cardiac thoracic surgery performed on infants aged 0 to 90 days following birth, regardless of gestational age. Regionalization was defined as developing a structured system of care that optimizes outcomes by concentrating high-acuity surgical neonates at high-volume centers with appropriate pediatric surgical support (e.g. specialists in pediatric anesthesia, pediatric radiology, pediatric critical care, etc.), and by improving the coordination of care for surgical neonates within a given geographic region.

The survey collected survey respondents’ demographic data and clinical practice characteristics. State population density was stratified by quintiles [7] and survey respondents were assigned to a quintile based on their reported state of primary practice.

Initial opinion regarding regionalization was obtained through responses to the single survey item, “I am in favor of formal regionalization”. Subsequently, attitudes toward regionalization were obtained through a 15-item scale developed for this study (Table 1). Survey items were intentionally worded to portray regionalization both positively and negatively. Each of the 15 items was answered on a 5-point Likert scale. Scores for negatively worded items were reversed and each respondent’s 15 individual item scores were then added to form a cumulative scale score. The range of possible scores was 15 to 75, with lower scores representing more favorable attitudes toward regionalization, and higher scores representing less favorable attitudes. At the end of the survey, respondents were asked to once again respond to the item, “I am in favor of formal regionalization”, as representation of their final opinion toward regionalization. Initial and final opinions were compared in order to assess if surgeons had a change in opinion after reading the survey items that highlighted the potential impact of regionalization.

Similarly, opinions of optimal resources necessary for neonatal surgical patients were ascertained through the use of a 5-item scale that was developed for this study (Table 1). Possible scores on this scale ranged from 5 to 25, with lower scores representing stronger opinion in support of having the designated resources available. Lists of pediatric medical and surgical subspecialties were provided to allow participants to select the specialties that they felt were important for optimal care of surgical neonates.

1.3. Data Quantification and Analysis

Classical test theory and component analysis were used to evaluate the psychometric properties of the survey. Classical test theory [8] is a model traditionally used to evaluate the statistical properties of a scale (set of items). The correlations between responses to individual items and the scale as a whole (item-total correlations) and the internal consistency (reliability) of the scale as a whole are among the statistics of interest. Component analysis [9] is a related model used to infer how many attributes or factors a scale represents, e.g., whether the scale is unidimensional (measures a single factor) or not (measures multiple factors). The component analysis used parallel analysis [10] to determine the number of components and a promax rotation.

In order to compare responses between survey respondents who work in environments with differing levels of resources, subjects were divided into groups based on hospital teaching status (with/without pediatric surgery fellows, and with/without general surgery residents). We selected teaching status as a reasonable proxy for resources because teaching programs have to periodically demonstrate availability of resources for purposes of accreditation.

Descriptive data were computed, and are presented as mean (SD) or median (interquartile range, IQR) as appropriate. Chi-square contingency table analysis and Mann–Whitney U tests were performed for group comparisons. Correlation was used to evaluate relationships between the continuous predictor variables (duration in practice and group size) with the scale scores. Statistical computations were performed using SAS 9.3 (SAS Institute, Cary, NC), and a p-value of < 0.05 was considered statistically significant.

2. Results

Email invitations to participate in the study were sent to 961 registered members of APSA and delivered to 916. Of the 916 pediatric

| Table 1
| Survey items.
| Regionalization Scale
| 1. Regionalization of neonatal surgical care will improve patient outcomes.
| 2. Regionalization of neonatal surgical care will allow more neonates to be treated in an environment with optimal resources.
| 3. Regionalization of neonatal surgical care will concentrate the most expensive therapies at a fewer number of centers.
| 4. Regionalization of neonatal surgical care will result in a need for more pediatric surgeons.
| 5. Regionalization of neonatal surgical care will facilitate the performance of research in pediatric surgery.
| 6. Regionalization of neonatal surgical care will improve the neonatal surgical training experience for future pediatric surgery fellows.
| 7. Regionalization of neonatal surgical care will make pediatric surgery a more popular field to join.
| 8. Regionalization of neonatal surgical care will increase my access to neonatal cases.
| 9. Regionalization of neonatal surgical care will limit the scope of my clinical practice.
| 10. Regionalization of neonatal surgical care will limit practice opportunities for pediatric surgeons.
| 11. Regionalization of neonatal surgical care will have a positive financial impact on my practice.
| 12. Regionalization of neonatal surgical care will foster an elitist environment in pediatric surgery.
| 13. Regionalization of neonatal surgical care will significantly increase travel burden for patients and families.
| 14. Regionalization of neonatal surgical care will have significant financial impact on patients and families.
| 15. Families will be in favor of regionalization of neonatal surgical care.
| Optimal Resources Scale
| 1. Neonatal surgical outcomes would be improved if pediatric surgeons were on call for only one NICU at a time.
| 2. Surgical problems in neonates should only be cared for by BC/BE (board-certified/board-eligible) pediatric surgeons.
| 3. Hospitals that care for surgical neonates should have a BC/BE neonatologist IN-HOUSE 24 h/day.
| 4. Hospitals that care for surgical neonates should have a BC/BE pediatric anesthesiologist available 24 h/day.
| 5. Hospitals that care for surgical neonates should have a BC/BE pediatric radiologist available 24 h/day.

* Scores reversed.
surgeons who received the survey, 380 (41.5%) started the survey, and
361 (39.4%) fully completed the survey. The year of completion of
pediatric surgery fellowship ranged from 1960 to 2012; median years
since fellowship was 16 (IQR = 9 to 25 years).

The number of board certified or board eligible (BC/BE) pediatric
surgeons in the survey participant’s practice ranged from 1 to >20
(median = 5, IQR = 3–8). Only 11 (2.9%) were from a practice of 20
or more BC/BE pediatric surgeons. Of the respondents, 146 (39.4%)
worked with pediatric surgery residents and 323 (87.1%) worked with
general surgery residents from an ACGME-accredited program at their
primary hospital.

2.1. Attitudes Toward Regionalization

This 15-item scale assessing attitudes towards regionalization
had very high reliability in this sample ($\alpha = 0.90$). Component
analysis indicated a two-factor structure. One factor consisted of
items portraying regionalization in a positive light, and one
comprised items portraying regionalization in a negative light. The
two factors were correlated to a relatively large extent ($r = 0.46$)
and may be interpreted as reflecting differences in the method of
asking the questions (positive vs. negative) rather than the content.
This structure was expected based upon the authors’ intentional
wording of survey items to achieve a balanced portrayal of attitudes
toward regionalization.

Overall, 63.4% of study participants responded favorably (score =
1 or 2) to the statement “I am in favor of formal regionalization” at
the beginning of the survey. Respondents from institutions with a
pediatric surgery training program ($n = 142$) were more in favor of
regionalization than those who did not work with pediatric surgery
trainees ($n = 221$) (1.73 vs. 2.74, $p < 0.0001$).

The mean score for the attitudes toward regionalization scale was
42.8 (SD 10.3) for all respondents. Those from institutions with an
accredited pediatric surgical training program tended to favor
regionalization more than those from institutions without (37.8 vs.
46.0, $p < 0.0001$). Similarly, those from facilities with general surgery
training programs ($n = 318$) also tended to favor regionalization
more than those from practices without general surgery residents
($n = 48$) (41.9 vs. 48.3, $p < 0.0001$).

Surgeons whose primary practice was at a free-standing
children’s hospital ($n = 211$) favored regionalization more than
those whose primary practice was in a general hospital with a NICU
and inpatient pediatric ward ($n = 147$) (39.8 vs. 46.8, $p < 0.0001$).
Only 6 surgeons’ primary hospital was a general hospital with a
NICU without an inpatient pediatric ward, making this group too
small for meaningful comparison.

Attitudes toward regionalization were also considered in relation
to years in practice and group size. The length of time in practice was
considered both as a continuous variable and as a categorical variable
(< 10 years, \(\geq 10\) years). Neither analysis revealed a relationship
between length of time in practice and score on the regionalization
scale. Group size was analyzed as a continuous variable and larger
group size was associated with more favorable attitudes toward
regionalization on the regionalization scale ($r = -0.30$, $p < 0.0001$).
Population density of the state of practice was not associated with a
difference in attitudes toward regionalization.

Fig. 1. (a) Optimal pediatric surgical specialties necessary for treatment of neonatal surgical patients. (b) Optimal pediatric medical specialties necessary for treatment of neonatal surgical patients.
The final survey item was a repeat of the first item, “I am in favor of formal regionalization”. Again, those from practices with training programs (1.92 vs. 2.96, p < 0.0001), and those from larger groups (r = −0.3, p < 0.0001) favored regionalization more. When the entire group’s response to this final question was compared to their initial response to the same question, the score on the final response was 0.2 higher than their initial response (2.55 vs. 2.34, p < 0.0001), indicating that respondents favored regionalization less at the end of the survey, though by a marginal amount. A smaller majority, 56.2%, responded favorably to this question at the end of the survey compared to the 63.4% who responded favorably at the beginning of the survey.

2.2. Optimal Resources

Opinions regarding optimal resources necessary for the treatment of pediatric surgical patients were assessed with the scale comprised of 5 survey items (α = 0.73) noted previously. The possible range of scores was 5 to 25. The mean score for the overall optimal resources scale was 8.9 (SD 3.7), with a lower score favoring the resources listed in each of the survey items.

Survey participants from facilities with an associated pediatric surgery training program favored the listed resources more than participants who were not affiliated with a training program (7.87 vs. 9.52, p < 0.0001). Those from institutions with general surgery trainees also favored a more resource rich environment (8.6 vs. 11.0, p < 0.0001), as did those whose primary practice was at a free-standing children’s hospital (8.1 vs. 9.9, p < 0.0001). In addition, the larger the respondent’s group practice, the more the respondent favored the listed resources (r = −0.24, p < 0.0001). There was no relationship between score on the optimal resources scale and length of time in practice or population density of practice state.

Fig. 1a shows the percentage of participants who endorsed the need for each surgical subspecialty to optimally treat surgical neonates. Fig. 1b shows similar results for the medical subspecialties.

3. Discussion

Regionalization of neonatal surgical care refers to the development of a structured system of care that optimizes outcomes by concentrating high-acuity surgical neonates at high-volume centers with appropriate pediatric surgical support, and by improving the coordination of care for surgical neonates within a given geographic region.

This study describes pediatric surgeons’ attitudes toward regionalization of neonatal surgical care in the United States and elucidates resources that pediatric surgeons consider to be necessary to provide optimal care for neonatal surgical patients. Our findings demonstrated that overall, the surgeons surveyed favored regionalization.

Groups that favored regionalization more strongly included surgeons whose practices were affiliated with general surgery and pediatric surgery training programs, and surgeons from larger group practices. One postulate is that many of these surgeons’ practices are located in larger urban medical centers that already have a broad range of resources readily available. Our findings may therefore be explained by the possibility that these surgeons, who already function in a de facto model of regionalized care, would stand to benefit further from formal regionalization. The benefits could be both financial and educational; regionalization would set up formal infrastructure to bring complex patients to their centers, allowing preservation of their training mission.

However, while surgeons from academic practices favored regionalization more, this opinion was not unanimous. The 15 survey items that make up the regionalization scale describe the potentially large scope of impact that regionalization. For each surgeon, regionalization would likely be positive in some regards and negative in others. Our use of the 15-item scale allowed us to measure each surgeon’s overall opinion toward regionalization as a summation of their opinions over the 15 questions. It is therefore not surprising that some surgeons felt that the advantages of regionalization outweighed the disadvantages, and other surgeons felt the opposite.

With regard to opinions on optimal resources necessary to treat surgical neonates, survey respondents who were affiliated with surgical training programs were more in favor of having a resource rich environment. While we did not ask respondents to declare the resources they have at their hospital, it may be that the respondents from training programs already function in environments with more resources, including some of those listed in the survey, and do not favor treating surgical neonates in an environment with fewer resources. Similarly, respondents without training program affiliation may be comfortable working in hospital environments that have fewer resources and therefore are not of the opinion that more resources are necessary.

Regardless, it is clear that there is a difference in opinion between surgeons whose practices are affiliated with training programs and those whose practices are not. While we might speculate why opinions differ, our survey does not reveal the true motivations behind the proponents and opponents for regionalization. Pediatric surgeon focus groups might be formed in the future to elicit these details, which will be crucial for successful development and implementation of regionalization strategies if they are undertaken.

From the standpoint of pediatric subspecialty expertise, our study identified the surgical and medical experts whom surgeons felt were necessary for the optimal treatment of surgical neonates. Specifically, greater than 50% of surgeons felt that specialists in pediatric otolaryngology, urology, neurosurgery, cardiac surgery, cardiology, infectious disease, gastroenterology, nephrology, pulmonology, hematology/oncology, and neurology are necessary to provide an environment that is optimal for treating this patient population.

One of the study’s interesting findings was the change in the survey participants’ responses to the statement “I am in favor for formal regionalization” from the beginning of the survey to the end of the survey. Between the two points in time at which this statement was offered, the survey participant was presented with survey items highlighting a comprehensive set of areas that regionalization might impact. Interestingly, attitudes toward regionalization became slightly less favorable after reading and responding to these survey items. A possible explanation for this is that participants’ opinions at the beginning of the survey were based on a limited understanding of the impact of regionalization, and their opinions changed as they were introduced to new areas of potential impact while taking the survey. We did not study participants’ baseline understanding of regionalization, and this limits our ability to understand the reason for this finding.

Another limitation of this study was our use of a convenience sample of APSA members. We did not include pediatric surgeons who were not APSA members, though they represent a minority. While our survey response rate was ~40%, which is significantly higher than response rates in prior surveys of the APSA membership [11,12], there still may have been inherent bias in those who chose to participate. As APSA does not have data on demographics or practice characteristics of its membership, we were not able to assess if the respondents were a representative sample of the APSA membership. However, in comparison to the 2009 survey on practice characteristics with 247 respondents [11], a larger proportion of our survey respondents were in academic practice (86.9% vs. 62.2%). We must therefore be mindful of the potential relative under-representation of pediatric surgeons in non-academic practices in this survey’s data.

This is the first study examining pediatric surgeons’ opinions regarding regionalization of care. The subject of the survey was surgical neonates, who are a high-risk population. Our survey’s findings are of particular import because the field of pediatric surgery treats several other high-risk patient populations. Future investigation is necessary to study whether pediatric surgeons’ opinions are
similar in regard to regionalization of care for other high-risk pediatric surgical patient populations.

Additionally, the question regarding the need for regionalization needs to be answered definitively. The relationships between resource availability, patient volume, surgeon volume, and risk-adjusted patient outcomes must be determined. These data will allow targeted development of regional and national strategies to optimize patient outcomes.

In summary, the majority of pediatric surgeons practicing in the United States, particularly those affiliated with training programs, do favor regionalization. The anticipated impact of regionalization would be multi-faceted. It potentially affects patient care and outcomes, family travel burden, surgical training, surgical practice, and research. While any model of regionalization should aim to improve patient outcomes, the professional views represented here must be taken into consideration. Surgeon involvement at the highest levels and surgeon education will be critical in these efforts.

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