

Abstract

Background: Neonatal Acute Kidney Injury (AKI) is common in neonatal intensive care units (NICU) and leads to worse outcomes. Stratifying neonates into an “at risk” category allows health care providers to objectively recognize opportunities for improvements in quality of care.

Methods: The “Neonatal AKI Risk Prediction Scoring” was devised as the “STARZ [Sethi, Tibrewal, Agrawal, Raina, waZir]” Score. The STARZ score was derived from our prior multicentre study analysing risk factors for AKI in neonates admitted to the NICU. This tool includes 10 variables with a total score ranging from 0 to 100 and a cut-off score of 31.5. In the present study, the scoring model has been validated in our multicentre cohort of 744 neonates.

Results: In the validation cohort, this scoring model had a sensitivity 82.1%, specificity 91.7%, positive predictive value 81.2%, negative predictive value 92.2% and accuracy 88.8%. Based on the STARZ cut-off score of ≥31.5, an area under the receiver operating characteristic (ROC) curve was observed to be 0.932 (95% CI: 0.910 - 0.954) [p<0.001] indicating high discriminative power. In the validation cohort, the probability of AKI was <20% upto a score 32, 20- 40% for scores 33-36, 40% – 60% for scores 36-43, 60 – 80% for scores 44-49, and ≥80% for a score of ≥50.

Objectives

Despite the significant morbidity and mortality associated with neonatal AKI, a standardized score model for stratifying the RISK of neonatal AKI does not exist. In order to make a AKI risk stratification tool for neonates, we performed a multicentre prospective cohort study from India, and a 'Risk Prediction Scoring' was created [The STARZ (Sethi, Tibrewal, Agrawal, Raina, waZir) Score]. The creation of this scoring model allows for the rapid identification of at-risk neonates for the already over-burdened health care personnel

Methods and Materials

Study Design

The study was a multicentre, national, prospective cohort study conducted in eleven centres across the country (India). All neonates who fulfilled the inclusion and none of the exclusion criteria at each of the participating centres with level 2-3 NICUs from September 2019 to August 2020 were enrolled.

Inclusion criteria

All neonates (≤28 days) admitted to the NICU with established intravenous access (IV) to receive IV fluids for at least 48 hours for hydration and/or nutrition were included in the study.

Results

	Validation cohort	Derivation cohort
≥31.5 score^, n (%)	181 (30.7%)	128 (41.3%)
AKI, n (%)	179 (30.4%)	111 (35.8%)
Sensitivity, % (95% CI)	82.1% (75.7% - 87.4%)	92.8% (86.3% - 96.8%)
Specificity, % (95% CI)	91.7% (88.6% - 94.2%)	87.4% (82.0% - 91.7%)
PPV, % (95% CI)	81.2% (75.7% - 85.7%)	80.5% (74.0% - 85.6%)
NPV, % (95% CI)	92.2% (89.6% - 94.2%)	95.6% (91.8% - 97.7%)
AUC, (95% CI)	0.93 (0.91 - 0.95)	0.96 (0.94 – 0.98)

Table 1: Predictive ability of STARZ model for AKI incidence within 7 days post-NICU admission in validation and derivation cohort

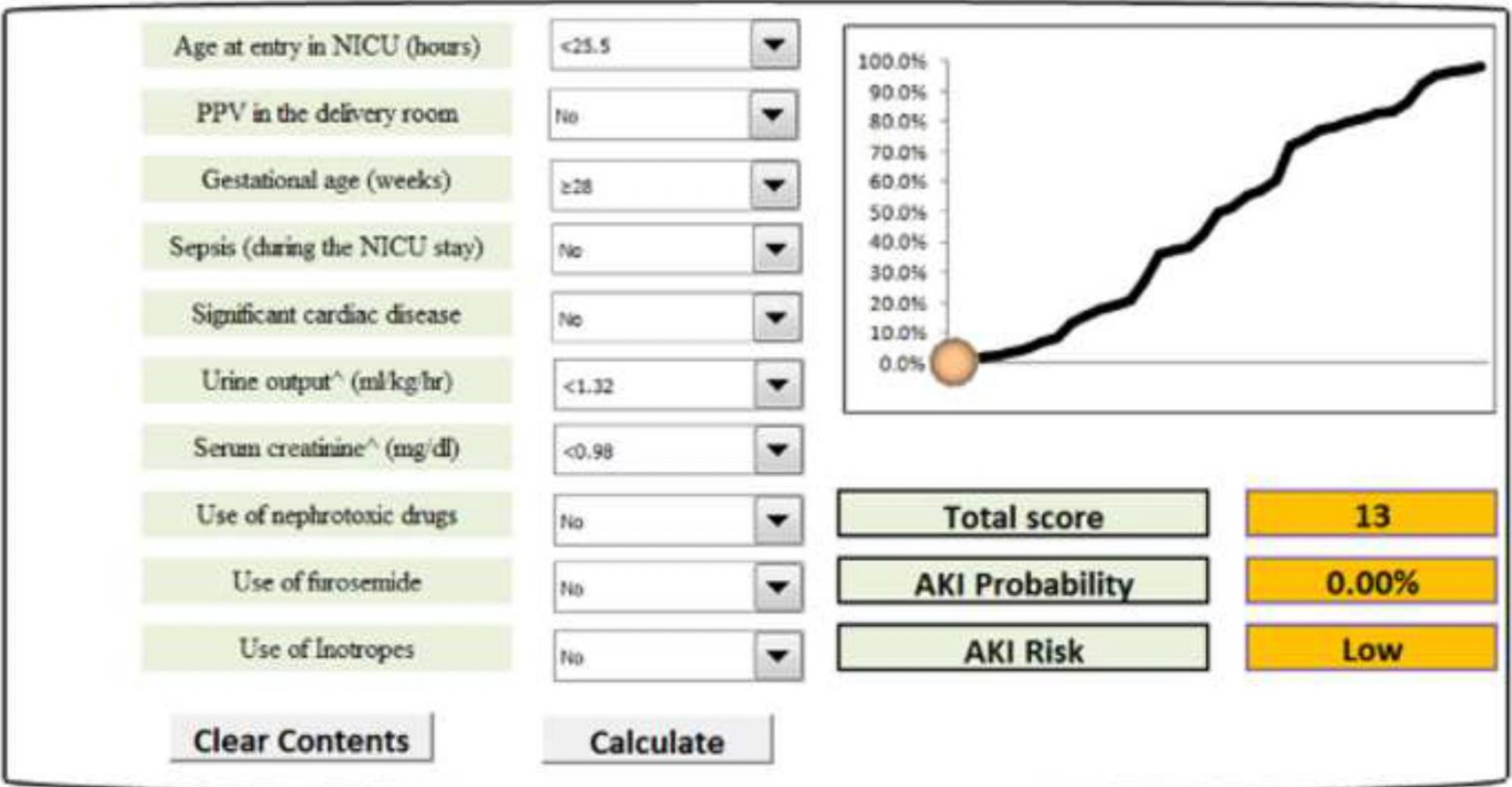


Figure 1: User friendly dashboard depicting the output of the scoring system for a low AKI risk children

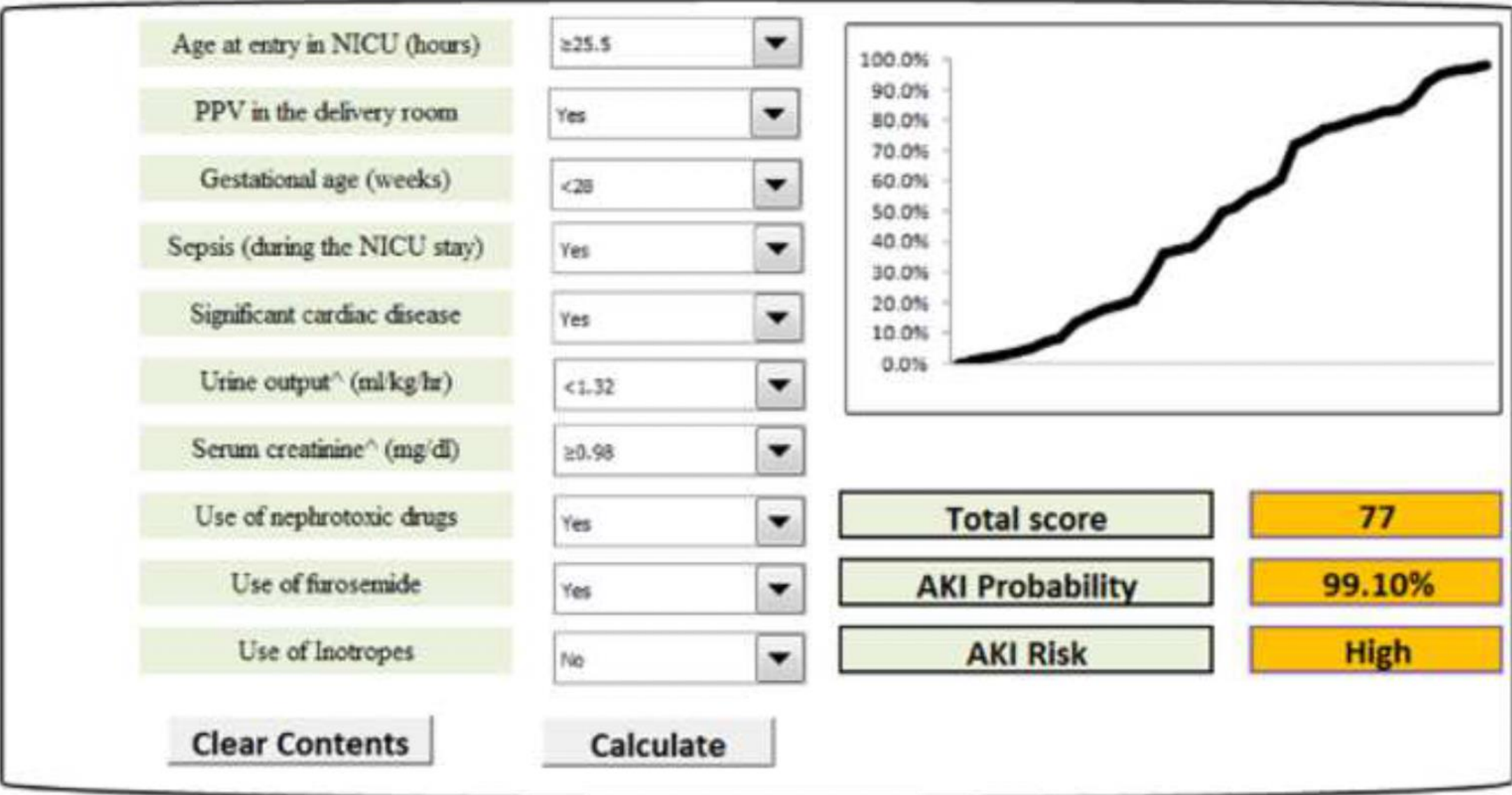


Figure 2: User friendly dashboard depicting the output of the scoring system for a high AKI risk children

Discussion

• A total of 744 neonates were included in this validation study (out of 1267 neonates screened) and 763 in the derivation cohort (out of 1386 neonates screened).

• The variables include clinical parameters (age at entry to NICU in hours, need for positive pressure ventilation in the delivery room, gestational age, sepsis, significant cardiac disease, urine output in the first 12 hours post-admission <1.32 ml/kg/hour, use of nephrotoxic drugs, use of furosemide or inotropes) and one laboratory parameter (serum creatinine in the first 12 hours post-admission ≥ 0.98 mg/dl)

• The total score for this model ranged from 0 to 100, where a higher score indicates greater risk of AKI incidence at 7 days. In our derivation cohort, this scoring model had a sensitivity of 92.8%, specificity of 87.4%, positive predictive value of 80.5%, and negative predictive value of 95.6% and accuracy of 89.4%

• In the validation cohort, the probability of AKI was <20% up to a score of 32, 20- 40% for scores 33-36, 40% – 60% for scores 36-43, 60 – 80% for scores 44-49, and ≥80% for a score of ≥50. Neonates with score ≥31.5 had a significantly higher incidence of AKI within 7 days, prolonged duration of NICU stay and increased risk of mortality. These findings were similar to the derivation cohort.

• We performed a similar validation study to evaluate the use of the STARZ score. In our study, the area under the ROC curve was observed to be 0.932 (95% CI: 0.910 - 0.954) [p<0.001] in the validation cohort, indicating high discriminative power of our AKI predictive score. The STARZ scoring model had a sensitivity of 82.1% [147/179], specificity of 91.7% [376/410], positive predictive value of 81.2% [147/181], negative predictive value of 92.2% [376/408] and accuracy of 88.8% [523/589].

Conclusions

Early recognition of AKI and rapid initiation of evidence-based interventions are crucial to promoting survival of at risk neonates. The STARZ neonatal score serves to rapidly and quantitatively determine the risk of AKI in admitted neonates.

References

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