Optimization of a Novel Hepatobiliary Scintigraphy Protocol

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Introduction

Radiology is an essential element of medical practice and provides an irreplaceable resource for patients and physicians. Many contrast imaging protocols involve extensive time periods during which the imaging device is on hold, waiting for the patient to be ready for the next series of image acquisition. This renders the device unavailable for the different patient, leads to inefficient use of the device, slows throughput, and potentially increases imaging costs. A novel imaging protocol for hepatobiliary scintigraphy recently outlined by Verma et al. provides a significant amount of open scanner time in a procedure that historically required 120 minutes to complete. The current study seeks to optimize the new imaging technique of hepatobiliary scintigraphy in a total imaging time of 10 minutes per patient.

Research Question

Can a novel hepatobiliary scintigraphy protocol requiring reduced scanner time be utilized to maximize scanner operation and decrease healthcare costs with equivalent diagnostic ability?

Materials and Methods

Theoretical models were created to maximize open scanner time utilization. The protocol was expanded to determine the maximum number of HIDA scans that could be run simultaneously by staggering scans within open scanner time between images. In order to establish a more feasible model, a transition time of three minutes was selected (Model 6), allowing for two minutes for positioning the patient on the scanner and one minute for the patient to exit. Model 6 was selected as a base model that was modified and expanded to include other imaging studies of varying duration. Potential optimization of stacked HIDA scans with other nuclear medicine imaging studies was investigated by inserting additional nuclear medicine imaging studies within remaining open scanner time.

Revenue was then estimated using Medicare data based on CPT codes. Revenue was then multiplied by the number of scans per cycle and cycles per day to determine gross revenue estimates per cycle and per day, respectively. Those estimations were extrapolated to estimate gross revenue per day and per year.

Results

The imaging models are outlined in Models 1 and 10, shown below. Figure 1 shows stacked HIDA scans, while Figure 2 shows optimization of stacked HIDA scans with other nuclear medicine imaging studies.

Figure 1: *Model 1: Seven stacked HIDA scans. Image time indicated in first row, with image acquisition times highlighted in yellow. Each row indicates a single patient (1 HIDA scan).*

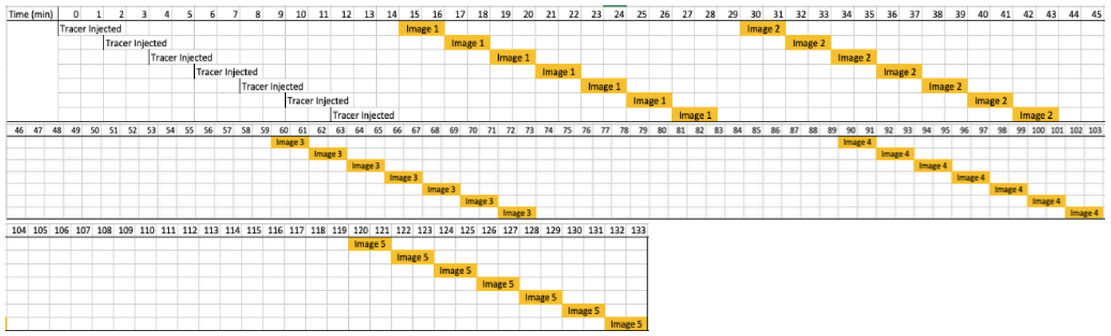
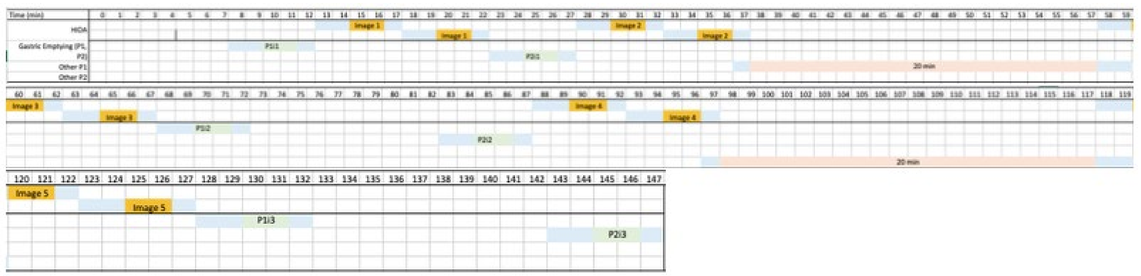


Figure 2: *Model 10: 2 HIDA scans, 2 Gastric Emptying studies, and 2 other 20-minute studies. Other unspecified 20-minute studies highlighted in pink.*



The data for stacked HIDA scan revenue (Model 1) are included in Table 1.

- Total time of stacked cycles increased from 8.07 hours for one HIDA scan to 8.87 hours for the theoretical model including 7 stacked HIDA scans.
- Revenue generated by preforming more scans per day increased from a gross income per day of $2840.00 for the base model to a theoretical $19,880.00 per day.
- Gross income per year increased from $741,240.00 to a maximum theoretical gross per year of $5,188,680.00.

Table 1: *Stacked HIDA scan revenue and duration.*

HIDAs/ Cycle	Total Time (hrs)	Gross Per Day	Gross Per Year (261 work days)
1	8.07	$2,840.00	$741,240.00
2	8.60	$5,680.00	$1,482,480.00
2	8.67	$5,680.00	$1,482,480.00
3	8.67	$8,520.00	$2,223,720.00
3	8.80	$8,520.00	$2,223,720.00
4	8.67	$11,360.00	$2,964,960.00
5	8.87	$14,200.00	$3,706,200.00
6	8.73	$17,040.00	$4,447,440.00
7	8.87	$19,880.00	$5,188,680.00

The data for HIDA scans with the addition of other imaging studies are included in Table 2.

- Total time ranged from 6.57 hours per day to 8.13 hours per day - 1.5 hours less than one HIDA scan to seven minutes more than one HIDA scan using the current protocol
- Revenue generated was the least in Model 9, which included 2 HIDA scans and 2 GE studies for a total duration of 7.35 hours.
- The highest revenue generator was Model 10 at 7.35hrs total run time and an estimated Gross Income per year of $2.69 million

Table 2: *HIDA scan with additional studies revenue and duration.*

Model #	Scans	Total Time (hrs)	Gross Per Cycle	Gross Per Year (261 work days)
9	2 HIDA + 2 GEs	7.35	$2,412.00	$1,888,596.00
10	2 HIDA + 2 GEs + 2 BS	7.35	$3,440.00	$2,693,520.00
11	1 HIDA + 3 BS	8.13	$2,252.00	$2,351,088.00
12	1 HIDA + 4 GEs + 3 BS	6.57	$4,236.00	$2,211,192.00

Conclusion

The current study provides multiple customizable models using a novel hepatobiliary scintigraphy protocol to enhance imaging center workflow and revenue. These models can be easily implemented to accommodate a variety of facility requirements. Strategic use of the models provided in this study can significantly increase productivity and income, and ultimately provide more high-quality and efficient care to patients.

Summary

- Excessive radiologic scan duration times limit imaging center efficiency, leading to decreased patient satisfaction and heightened facility costs.
- The models created in this study demonstrate how a novel hepatobiliary scintigraphy protocol can be utilized with equivalent diagnostic ability to maximize scanner operation.
- The models allow for customization based on facility preference and capability in order to decrease costs, generate revenue, and improve patient satisfaction.

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References

- Verma, N., Schielke, D., Singer Pressman, M., & Millstine, J. (2017). Serial static image acquisition provides similar results to continuous dynamic image acquisition for sincalide-stimulated gallbladder ejection fraction calculation. *Journal Of Nuclear Medicine*, *58*.