Primary hyperparathyroidism is the most common cause of hypercalcemia in ambulatory patients and is caused by autonomously overproducing parathyroid hormone. To date, surgical excision of the overactive parathyroid tissue is the only cure for primary hyperparathyroidism. With the advent of preoperative localizing imaging, the operation has evolved from bilateral neck exploration into a minimally invasive, scan directed procedure. We have found combining technetium-99m sestamibi single photon emission computed tomography (SPECT) with anatomic computed tomography (CT) is the most accurate preoperative imaging modality. With the advent of SPECT/CT, nuclear uptake can be correlated to anatomy, making it useful for pre-operative planning for targeted surgical procedures (Figure 1).

SPECT/CT fusion imaging has been obtained on each surgical patient with primary hyperparathyroidism at Geisinger Medical Center since 2008. We compared the operative times of patients with localizing scans to those with non-localizing scans.

**METHODS AND MATERIALS**

A retrospective chart review of 290 consecutive patients diagnosed with primary hyperparathyroidism (January 1, 2008 to September 30, 2011) to compare the operative times in patients with localizing SPECT/CT fusion images to operative times in those with non-localizing SPECT/CT imaging was conducted. The patient’s age, pre-operative biochemical profile (serum calcium and PTH levels), intra-operative findings, intra-operative rapid parathyroid hormone (IOPTH) levels and post-operative calcium levels were reviewed.

Parathyroid exploration was performed by a single attending surgeon (PKP). Directed surgical exploration was utilized in appropriate patients and included targeted neck exploration and the use of rapid intra-operative PTH (IOPTH). A bilateral comprehensive neck exploration was performed in patients for which IOPTH levels did not decrease by 50% at 10 minutes or those patients in whom preoperative imaging was non-localizing. The operative time of each case was defined as the time from skin incision to the time of removal of all overactive parathyroid tissue. A 50% decrease in PTH levels from baseline at 10 minutes and a value lower than the upper limits of laboratory normal (<65pg/mL) was deemed to indicate successful excision of hyperfunctioning tissue.

**RESULTS**

Two hundred fifty-six patients (88.3%) had a positive preoperative localizing imaging study and the remaining 34 (11.7%) were non-localizing. The sensitivity and specificity of SPECT/CT in localizing hyperfunctional parathyroid tissue was 91.8% and 64% respectively. The positive and negative predictive value was 96.5% and 42.1% respectively.

The pre-operative PTH level was significantly higher in the positively localizing group (108pg/mL) compared to the non-localizing group (89.5pg/mL) (p=0.0061). Similarly, the pre-excision IOPTH level was significantly higher in the positive localization group (152.0 pg/mL) compared to the negative localization population (118.5 pg/mL) (p=0.0149) (Table 1).

The difference between the two groups’ operative time was statistically significant (p<0.0001). The operative times in the localizing group was significantly less by a median of nine minutes (95% CI). Specifically, the localizing group’s median operative time was 15 minutes compared to 24.5 minutes for the non-localization group (Chart 1).

**DISCUSSION**

The use of SPECT/CT has increased the accuracy of preoperative localization. The current investigation yielded positive pre-operative localization in 88.3% of patients, which is similar to that demonstrated in recent reports.1-3 Our study demonstrated a significant (P<0.0001) decrease in operative time in patients with localizing pre-operative SPECT/CT (15 minutes) compared to a non-localizing scan (24.5 minutes). These findings support the use of SPECT/CT for pre-operative localization in preparation for directed exploration, thus providing a precise location of the hyperfunctioning parathyroid tissue in the neck. This allows the surgeon the benefit of focused surgery, not only to a particular side of the neck, but also a specific anatomic location of the suspected abnormal gland relative to surrounding supportive and visceral structures.

**CONCLUSIONS**

The findings of this investigation demonstrate that implementation of targeted parathyroid exploration in patients with a positive preoperative SPECT/CT imaging will reduce overall operative time. As with all variations in surgery for primary hyperparathyroidism, success rates for alternative techniques must be compared to bilateral exploration. The approach described in this report compares favorably in this respect while offering the capability of reducing operative time safely and effectively.

**REFERENCES**

