

## **Audit: Investigating appropriateness of primary care Parathyroid Hormone requests at Glasgow Royal Infirmary Biochemistry laboratory**

### **Aim**

To investigate whether the requests for Parathyroid Hormone (PTH) analysis received at Glasgow Royal Infirmary (GRI) biochemistry lab from primary care were appropriate or not.

The NICE guideline from 2019 'Hyperparathyroidism (primary): diagnosis, assessment and initial management'<sup>1</sup> was used as gold standard to compare practice to.

In this guideline it is recommended that:

“1.1.5 Measure parathyroid hormone (PTH) for people whose albumin-adjusted serum calcium level is either:

2.6 mmol/litre or above on at least 2 separate occasions or

2.5 mmol/litre or above on at least 2 separate occasions and primary hyperparathyroidism is suspected. “

They also recommend to “use a random sample and do a concurrent measurement of the albumin-adjusted serum calcium level.”

They list the following examples of symptoms and blood results that may indicate primary hyperparathyroidism :

“Symptoms of hypercalcaemia, such as thirst, frequent or excessive urination, or constipation

osteoporosis or a previous fragility fracture (for recommendations on assessing the risk of fragility fracture in people with osteoporosis, see the NICE guideline on osteoporosis)

a renal stone (for recommendations on assessing and managing renal stones, see the NICE guideline on renal and ureteric stones)

an incidental finding of elevated albumin-adjusted serum calcium (2.6 mmol/litre or above).

## **Method**

A data search was done from Telepath. This online system is used to log samples received in the lab as well as to view results before they are released to other online systems used in the trust. A search was run looking for all PTH requests run between 01/06/21 and 31/08/21. The search was expanded to also include; CHI number, Lab number/Specimen number, sex, location, Date collected, Time collected, Date received, Time received, clinical details.

Where applicable the following additional blood test results were included in the data search; alkaline phosphatase (ALP), albumin, sodium, potassium, urea, creatinine, estimated Glomerular Filtration Rate (eGFR), chloride, adjusted calcium, phosphate and vitamin D.

For this audit we chose to only look into PTH requests from the community and so all PTH requests from secondary care were disregarded. These results were then input into a Microsoft excel sheet for further analysis.

## Results

Between 01/06/21 and 30/08/21 a total of 289 PTH tests were requested by primary care.

The purpose of this audit was to look into the reasons why these tests were requested. This was determined by looking at the clinical details provided and these requests were grouped into similar reasons, as outlined in Table 1 and Chart 1.

The most common reason for a PTH request was due to low calcium levels on previous blood results (18.69%). This was followed by high calcium levels (9.34%), requests as per secondary care (6.23%), low vitamin D levels (5.54%), raised ALP levels (3.81%) and bone or joint pain (3.46%). 16.26% of requests were for monitoring purposes and unfortunately 12.11% of all requests had no clinical information provided.

Other reasons for requests included raised phosphate (9), query osteoporosis or osteomalacia (6), lethargy (5), myalgia or cramps (5), diabetes mellitus or high blood sugar levels (4), low phosphate levels (4), Chronic Kidney Disease or Acute Kidney Injury (2), neck lump or lymphadenopathy (3), to measure other blood markers (3), post gastric bypass (3), abdominal symptoms such as pain/bloating/altered bowel habit/nausea (3) and confusion or memory loss (2).

All requests that only appeared once were counted under the “miscellaneous” category. This category totalled 8.0% of requests. Some examples include; weight loss, peripheral oedema, haematuria, monitoring post thyroidectomy and paraesthesia.

Reasons for request were then assigned as “appropriate” or “inappropriate” requests. A request was deemed “appropriate” if it was for high serum calcium levels, low serum calcium levels, requested by secondary care or with raised ALP levels in the context of low serum calcium to query osteomalacia. None of the 11 “high ALP” requests were in the context of low calcium but 3 were in relation to low Vitamin D levels. If we apply this to the results found then only 99 of the 289 requests were “appropriate” (34.25%). See Tables 2 & 3 and Charts 2 & 3. This leaves almost two thirds of all requests received in this 3 month period as ‘inappropriate’ requests.

Reason For Request	Number of requests	% of Total Requests
Low calcium	54	18.69%
Monitoring	47	16.26%
Nil reason given	35	12.11%
High calcium	27	9.34%
Miscellaneous	23	7.96%
Requested by secondary care	18	6.23%
Vitamin D Deficiency	16	5.54%
Raised ALP	11	3.81%
Bone/joint pain	10	3.46%
Raised phosphate	9	3.11%
?osteoporosis/osteomalacia	6	2.08%
Myalgia/cramps	5	1.73%
Lethargy	5	1.73%
Diabetes mellitus/high blood glucose	4	1.38%
Low phosphate	4	1.38%
Post gastric bypass	3	1.04%
Neck lump/lymphadenopathy	3	1.04%
Measure other blood markers	3	1.04%
Confusion/memory loss	2	0.69%
Abdominal pain/bloating/altered bowel habit/nausea	2	0.69%
CKD/AKI	2	0.69%
<b>Total number of requests</b>	<b>289</b>	

*Table 1: Reasons for PTH Request*

# Reasons for PTH Requests

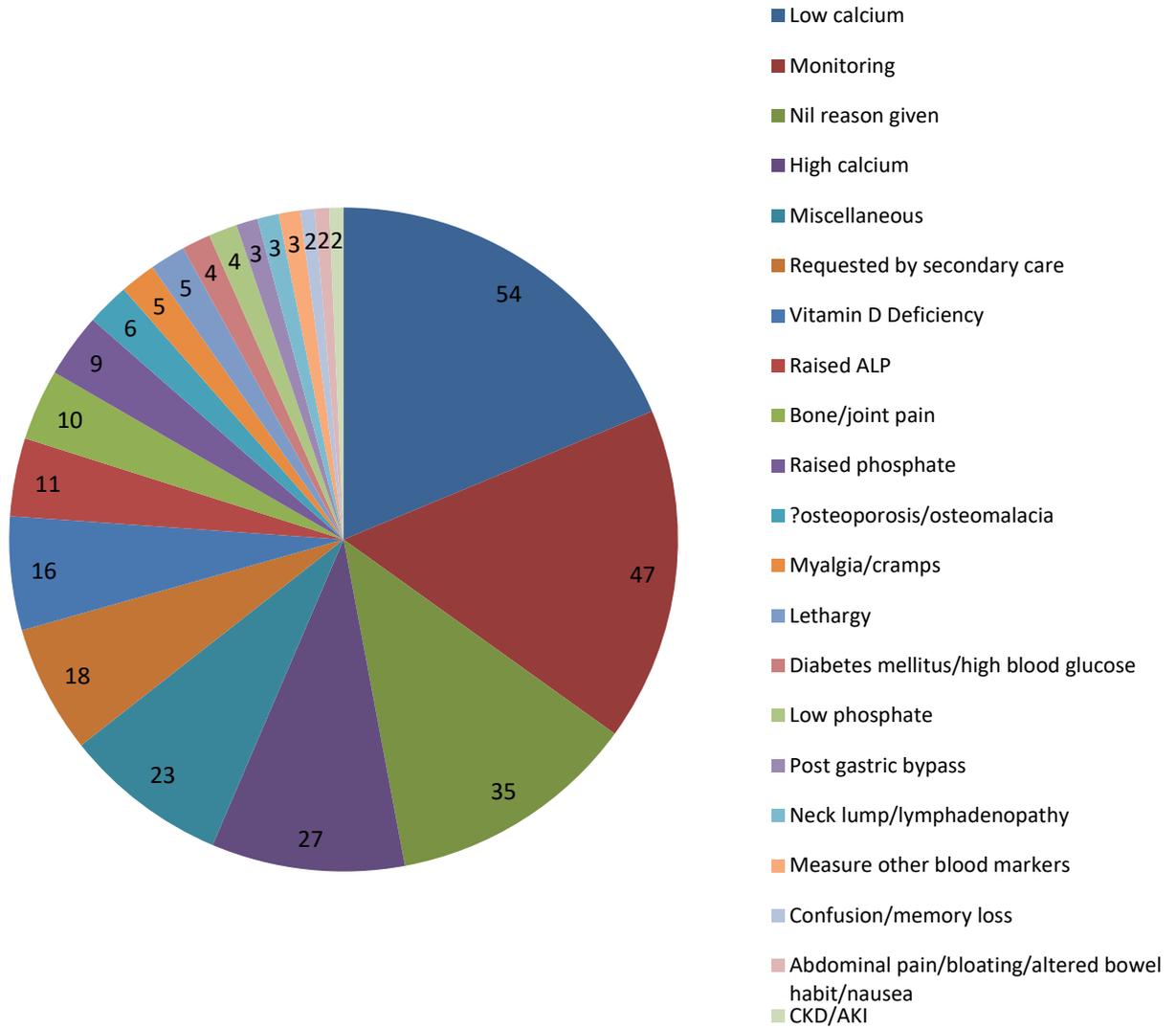


Chart 1: Reasons for PTH Request

Appropriateness of Request	Number of Requests	% of Requests
"Appropriate"	99	34.26%
"Inappropriate"	190	65.74%

Table 2: "Appropriateness" of PTH Requests

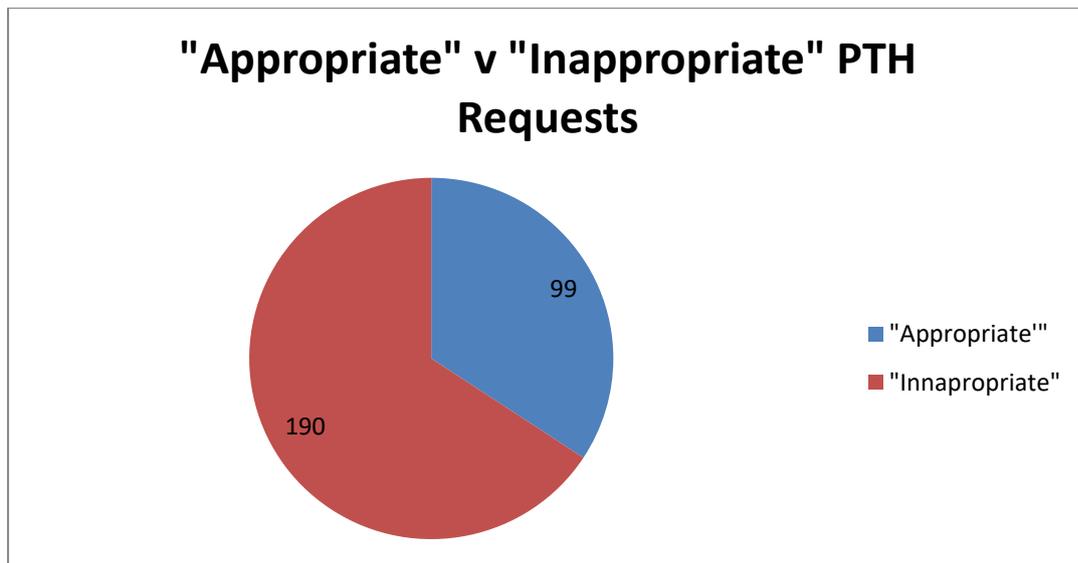


Chart 2: "Appropriate" v "Inappropriate" PTH Requests- Number of Requests

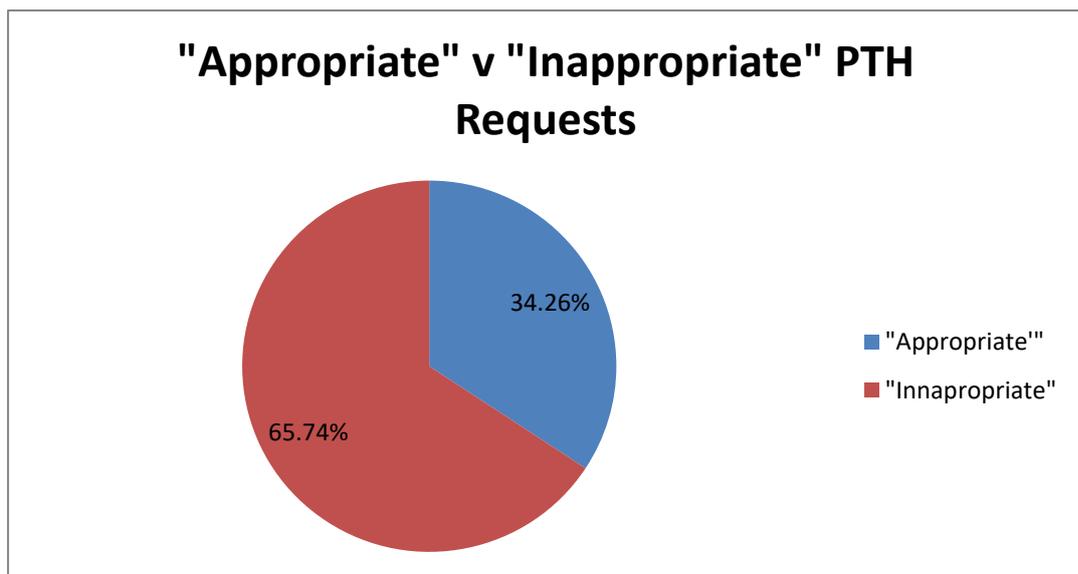


Chart 3: "Appropriate" v "Inappropriate" PTH Requests- % of Requests

Appropriate Reason for Request	Number of Requests	% of Requests
Low Calcium	54	54.55%
High Calcium	27	27.27%
Requested by Secondary Care	18	18.18%

Table 3: Reasons for "Appropriate" PTH Requests

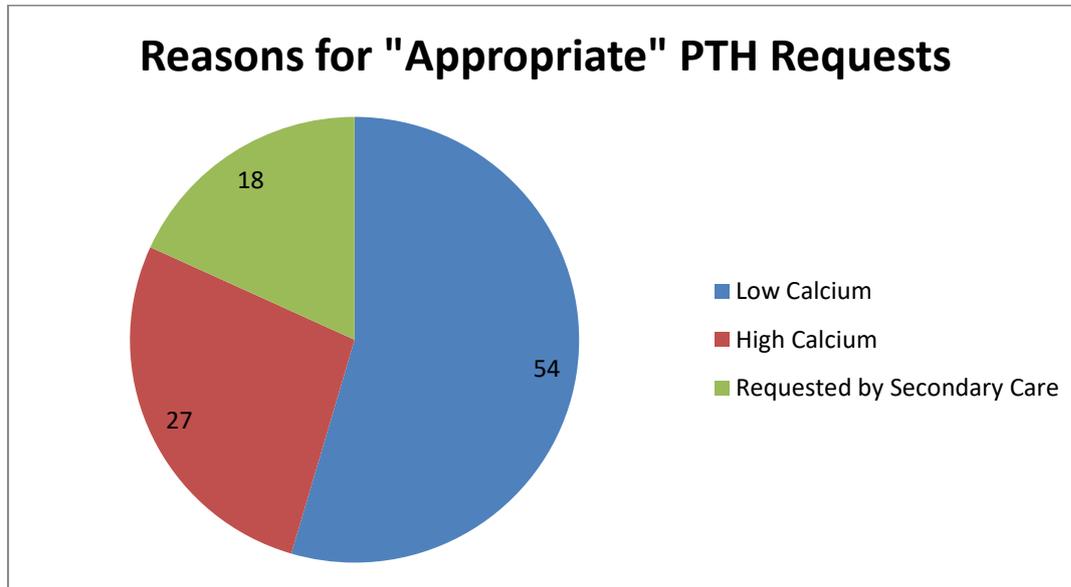


Chart 4: Reasons for "Appropriate" PTH Requests- Number of Requests

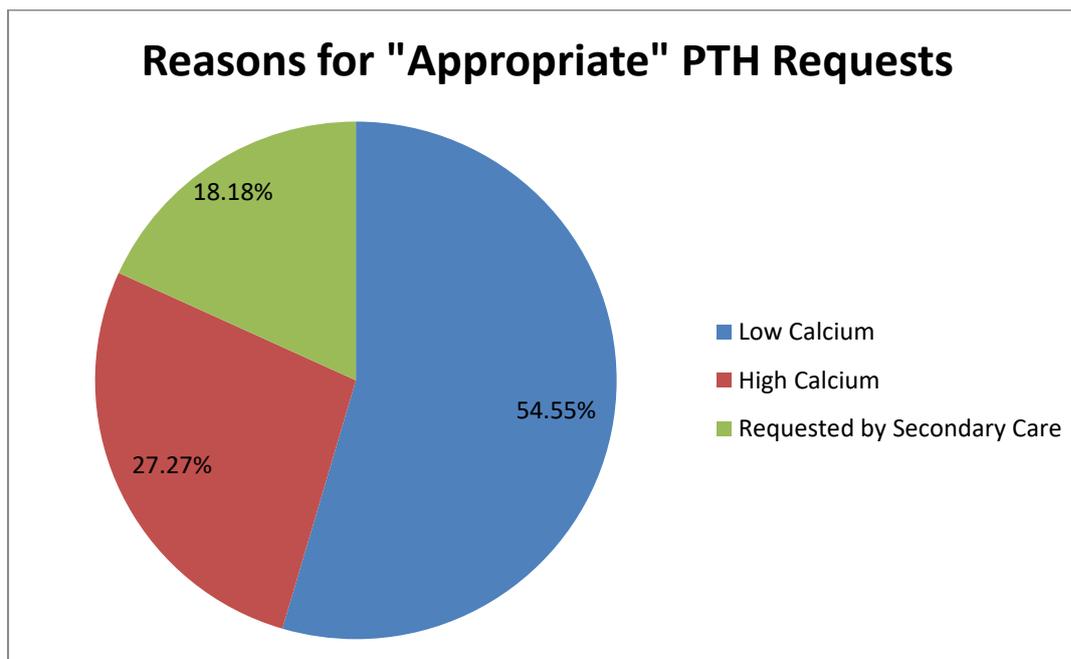


Chart 5: Reasons for "Appropriate" PTH Requests- % of Requests

## Interpretation

As outlined in the introduction section the nice guideline for investigating primary hyperparathyroidism in primary care recommends testing for PTH when adjusted-calcium level is raised. From the results we can see that this was only the reason for request in 9.3% of cases. There is only one NICE guideline pertaining to PTH testing and it is in the context of suspected primary hyperparathyroidism. As over 90% of requests for PTH did not fall into this category there are clearly many other reasons that GPs are requesting PTH levels in the area.

Low calcium levels accounted for twice as many requests (18.7%) as high calcium levels. The normal physiological response expected to low calcium levels in the blood would be for PTH levels to be raised, aka secondary hyperparathyroidism. The most common causes for secondary hyperparathyroidism are chronic kidney disease, malabsorption of calcium and low vitamin D levels. CKD was mentioned in two blood requests, whilst low vitamin D levels were mentioned 16 times. There is a well known high incidence of vitamin D deficiency in Scotland with the Scottish government website even recommending that everyone living in Scotland should at least consider taking Vitamin D supplements during the winter months.<sup>2</sup>

In the case of low calcium with low or inappropriately normal PTH levels this would indicate hypoparathyroidism. Primary hypoparathyroidism, due to failure of PTH secretion by the parathyroid glands, is rare and usually a result of autoimmunity or congenital e.g. Di George syndrome. Secondary hypoparathyroidism as a result of radiation or surgery to the thyroid and parathyroid glands is more common and one patient in the study period was being followed post-thyroidectomy.

'Raised ALP' levels were the reason for request in eleven cases. This request was deemed 'appropriate' if the result was associated with low calcium levels, as in osteomalacia. This was not true in any of the eleven cases. It may be that there has been incorrect information disseminated amongst local GPs that PTH should be checked first line in raised ALP levels, rather than say first checking gamma GT to see if raised ALP is due to a liver source. Further discussion with these GPs as to reasoning for request may help to understand this trend.

Another aim of the study was to assess the financial impacts of "inappropriate" testing. The NHS cost price per PTH run in GRI biochemistry lab is £9.89 purely based on reagent cost. Going off "appropriate" versus "inappropriate" guidelines set out in the study 190 requests were "inappropriate". This roughly equates to £1,879.10. If this data is then extrapolated to a 12 month period then potentially £7,516.40 could be avoided in costs.

### *Limitations of Study*

The main limitation of the study was that on the Telepath system only a set number of characters outlining the sample request reason can be read. This meant that in some cases important information in the sample request may have been missed off. There was unfortunately no way to view this information elsewhere.

Another limitation was time/resources to carry out the audit so only a three month sample period was used and then extrapolated over the year. Due to many changes in primary care provision as a result of the COVID-19 pandemic this three month window may not have been truly reflective of pre-pandemic practice. It may in fact underplay the usual number of requests as many patients are

reticent to attend GP surgeries in person due to fears of infection risks. Furthermore, the number of 'face to face' appointments available to GPs has decreased as a result of the pandemic. There is therefore a potential for clinicians to rely on biochemical tests more than usual in diagnosing patients.

### *Recommendations*

There is scope for education of GPs within the trust around PTH requests and when this may be appropriate. This could be in the form of a mass email, poster or educational talk. The number of requests, and their reasons for request, could then be re-audited to see if educational intervention had decreased the number of 'inappropriate' requests.

## **Conclusion**

In conclusion, almost two thirds of PTH requests audited over a three month window were deemed to be “inappropriate”. This is potentially costing the trust thousands of pounds each year, which given current financial constraints on the NHS could be used elsewhere within the trust. Staging an educational intervention for GPs within the trust, then re-auditing PTH requests would complete this audit cycle.

## References

- 1- <https://www.nice.org.uk/guidance/ng132/resources/hyperparathyroidism-primary-diagnosis-assessment-and-initial-management-pdf-66141715991749>
- 2- <https://www.gov.scot/publications/vitamind-advice-for-all-age-groups/>