The Experience of Parathyroidectomy when Treating Primary Parathyroid Hyperplasia

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Background: Total parathyroidectomy with forearm autograft (TP) and subtotal parathyroidectomy (SP) are the two widely-accepted surgical procedures for treating primary parathyroid hyperplasia. Although TP carries an increased risk of permanent hypoparathyroidism and implantation site recurrence, it is still the preferred option of some surgeons. This retrospective study's aim is to confirm the superiority of initial TP when treating primary multiple gland hyperplasia.

Methods: All patients who had received parathyroidectomy for primary multiple gland hyperplasia from 1987 to 2007 were reviewed. Two modalities of parathyroidectomy were used; these were subtotal parathyroidectomy (3 1/2, SP) as the standard initial treatment strategy and TP for disease recurrence or synchronous thyroid abnormality.

Results: A total of 14 patients were treated and these had a median follow-up period of 98 months (range, 51~216). Among these patients, 11 received SP and 3 underwent TP. Seven out of the 11 SP patients (63%) developed postoperative disease recurrence. Of the seven patients who received neck re-exploration, six (85%) demonstrated temporary postoperative hypocalcemia compared with the first operation (14%) ($p = 0.003$). Four of these patients (57%) experienced recurrent laryngeal nerve palsy, which was significantly higher than the rate after the first operation (0%) ($p = 0.006$). Therefore, cervical re-exploration carried a significantly elevated overall complication rate compared to initial neck exploration ($p = 0.002$). Of the three initial TP patients, one showed recurrence at the implantation site. All eight recurrence cases underwent re-operations that significantly reduced their serum calcium concentrations (12.55 to 8.7 mg/dL, $p = 0.008$) and parathyroid hormone levels (135 to 70 pg/mL, $p = 0.008$) compared with their respective levels just before re-exploration; this group had a 10-year recurrence-free rate of 45%.

Conclusion: Re-operations for recurrent disease are common regardless of the type of primary surgery. Compared with initial TP, re-operation for post-SP disease recurrence was associated with a significantly higher complication rate. TP would seem to be recommended as the choice of initial surgical procedure.
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Key words: parathyroid hyperplasia, total parathyroidectomy, subtotal parathyroidectomy, autograft

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Primary hyperparathyroidism (PHPT) is a common endocrine disease caused by high circulating levels of parathyroid hormone in spite of hypercalcemia. It is most commonly caused by a single adenoma in the majority of patients (up to 90%), followed by hyperplasia (9%), with carcinoma accounting for only less than 1%.[1] In our previous report we showed similar incidences of 93.6%, 5.4%, and 1%, respectively.[2] Currently, surgery is still the treatment option of choice for PHPT. Parathyroidectomy for adenoma has been standardized worldly,[3] whereas the extent and optimal timing of parathyroidectomy for hyperplasia remains controversial. Re-operations for disease recurrence are much more common in hyperplasia patients than in those with a single adenoma because of multiple gland involvement in the former.

The basic goals of surgery for parathyroid hyperplasia include reversal of hypercalcemia and maintenance of a sustained eucalcemic state, prevention of postoperative hypocalcemia and other operative morbidities as well as facilitating future surgery for any recurrent disease. There are basically three options in common surgical practice, including total parathyroidectomy with heterotopic autograft (TP),[4-6] subtotal parathyroidectomy (SP)[7-9] with vascularized remnant in situ in the neck, and less than subtotal parathyroidectomy.[10] The outcome of all three of these operations remain suboptimal.[7,10,11] SP has a lower incidence of permanent hypoparathyroidism,[7-9] while TP has an increased risk of permanent hypoparathyroidism. Re-operation for recurrent disease is easier for TP because recurrence is at the implantation site. Both TP and SP have been equally advocated for the treatment of parathyroid hyperplasia in the literature without enough prospective randomized data to clearly indicate the optimal approach. The aim of this study is to compare the clinical outcomes of patients who have received TP or SP for the treatment of PHPT from multiple gland hyperplasia in a single medical center.

METHODS

Patient population

From 1987 to 2007, all patients underwent definite cervical exploration for PHPT in the context of primary multiple gland hyperplasia at Chang Gung Memorial Hospital–Kaohsiung Medical Center; these cases were retrospectively reviewed. The diagnosis was confirmed pathologically in all cases. Complete follow-up information was obtained for all patients from the medical records.

Operative procedures

In this series, SP is defined as the excision of three and a half parathyroid glands after the identification of all four glands, leaving a remnant of the most normal-looking gland in the neck, this having a size of approximately 0.5 x 0.5 x 0.5 cm (60 mg). If less than four parathyroid glands were identified, the possibly unidentified gland was neglected and the same amount of glandular tissue was left in situ after removal of all identifiable parathyroid tissue. Efforts were made to remove supernumerary glands and remnants of parathyroid tissue in the neck by the resection of fatty tissue from the central neck compartment and transcervical thymectomy in all patients. TP is defined as total parathyroidectomy with immediate autotransplantation, including the exploration and removal of at least 4 glands combined with implantation of 10-20 one cubic millimeter pieces of parathyroid tissue (60 mg) into three separate subcutaneous pockets in the forearm. Procedures for the cervical tissue resection and transcervical thymectomy for removing possible supernumerary glands and remnant parathyroid tissue were the same as for SP. All of the identified parathyroid glands were confirmed by intra-operative frozen histological analysis on 0.3 x 0.3 x 0.3 cm of excised tissue. Intraoperative PTH measurement was not available at our institute during the study period and, therefore, was not performed routinely on the patients in this series. The rest of the removed parathyroid tissue from both SP and TP was routinely cryopreserved. Although SP was the procedure of choice, TP was performed in patients with concomitant thyroid anomalies. The choice of surgical strategy for recurrent hyperparathyroidism after SP depends on the results of imaging localization of the recurrent gland. If the imaging study identified a recurrence on the side of the residual gland, ipsilateral neck re-exploration was performed for residual gland removal, whereas bilateral neck explorations were performed when imaging analysis showed a suspicious lesion on the other side or demonstrates equivocal findings. Under all circumstances, residual cervical glandular tissue is completely removed with

autoimplantation of 60 mg of parathyroid tissue on the forearm. For patients after TP, recurrence at the forearm autograft was treated by removal of the macroscopically pathological fragments under local anesthesia; this was done if the iPTH gradient was positive, the forearm parathyroid tissue was detected in the sestamibi scan, and the tissue fragment was palpable on the forearm. All parathyroid tissue was partially removed, leaving about half of the tissue (0.5 x 0.5 x 0.5 cm; around 60 mg) in situ, or the equivalent amount was retransplanted after complete excision.

Postoperative management protocol

Serum levels of calcium, phosphorus, iPTH, and alkaline phosphatase were measured 24 hrs and one week after surgery during hospitalization. The patients were followed every month for six months for the evaluation of hypocalcemia, disease recurrence, or persistence of hyperparathyroidism. In case of postoperative hypocalcemia, calcium and vitamin D were administered, and the patient was followed every month for dosage adjustment. Subsequently, serum calcium and iPTH levels were determined annually to detect disease recurrence. For patients having received TP, venous blood was collected from both forearms for iPTH quantification to determine the gradient between the graft-bearing and non-graft-bearing arms.[12] Laryngoscopic examination was arranged for all patients presenting with either postoperative choking or hoarseness on follow-ups at our outpatient clinic for the diagnosis of recurrent laryngeal nerve injury.

Diagnosis of disease recurrence and pre-operative work-up

Disease recurrence was defined as laboratory findings of elevated serum calcium and iPTH levels over 10.1 mg/dL and 65 ng/L, respectively, after a postoperative follow-up period of at least 6 months. Surgical intervention for recurrent hyperparathyroidism is considered when there were non-specific clinical presentations such as peptic ulcer, bone pain, constipation and urolithiasis, together with positive imaging findings including Tc-99m sestamibi scan of the neck or of the grafted arm as well as computed tomography (CT) of neck. CT of the upper chest and neck was performed in patients after receiving TP who showed a negative Casanova provocative test,[13] namely a negative iPTH gradient of the graft-bearing arm versus the contralateral arm or a positive sestamibi scan of the neck. Preoperative localization studies including sestamibi scan and neck CT were performed in seven patients who had recurrent hyperparathyroidism and who required a second neck exploration that was conducted under general anesthesia on the side of the positive finding by imaging localization.

Statistical analysis

All data were expressed as mean with 95% confidence interval (CI) and medians with interquartle range (IQR). Statistical significance was assessed by Wilcoxon signed rank test for evaluating the treatment difference in serum parameters before and after second operation for disease recurrence. A Chi-square test (Fisher exact test) was used for comparison of the complication rates between the first and second operation. The recurrence free rate was determined by the Kaplan-Meier method. Statistical analyses were performed using SPSS. Median values were adopted to express the average values due to the small sample size in this study. A p value less than 0.05 is considered significant.

RESULTS

Patient demographic and disease characteristics

A total of 14 patients had been operated by one of the authors (F.F.C.) and were enrolled in this study (Table 1). There were ten females and four males with ages ranging from 18 to 61 years (median: 44.5) at the time of primary surgery. With regard to associated disease, five seemed to be sporadic cases with (Patients 11 and 14) or without (Patients 10, 12, and 13) a family history of endocrine tumors; these also showed no manifestation of any other concomitant endocrine tumor. Whereas the remaining nine cases (Patients 1-9) were accompanied by at least one other synchronous or metachronous site-specific endocrine tumor. The median serum calcium level of the patients before their first surgery was 12.45 mg/dL (range, 10.6 to 14.4) with a median serum iPTH of 168.5 pg/mL (range, 71 to 285). Although all 14 patients were treated surgically through neck exploration with the intention of performing subtotal parathyroidectomy ($3^1/_2$, SP) initially for multiple

Table 1. Patient Characteristics and Baseline Data

Patient No.	Age	Sex	Associated disease	Pre-op iPTH (pg/mL)	Pre-op Ca (mg/dL)	Glands no. (pathological /biopsied)	Initial surgical procedure	Recurrence	Total follow-up (months)
1	18	M	Pu, Pa	205	14.2	4/4	SP	R	75
2	41	F	Pu	175	12.2	4/4	SP	--	121
3	23	F	Pu, Pa	162	13.5	3/4	SP	R	216
4	47	F	Pa	71	11.7	2/3	SP	R	156
5	56	F	Pu	123	13.2	3/4	SP	R	87
6	36	M	Pu, Pa	285	14.4	3/4	SP	--	61
7	29	F	Th, Ad	91	12.3	3/4	TP	R	134
8	44	M	Th, Ad	142	12.8	2/4	TP	--	81
9	50	F	Th, Ad	219	10.6	1/3	TP	--	148
10	45	F	NA	228	11.3	2/3	SP	--	51
11	48	F	Th*	117	12.5	2/4	SP	R	105
12	30	F`	NA	182	12.4	4/4	SP	R	188
13	61	F	NA	128	13.1	1/4	SP	--	91
14	52	M	Ad*	200	11.8	3/4	SP	R	77
Mean 95% (CI)	41.43 (34.1-48.7)	-	-	166.29 (132.4-200.1)	12.57 (11.95-13.18)	-	-	-	113.64 (85.29-141.99)
Median (IQR)	44.5 (29.75-0.50)	-	-	168.5 (121.5-208.5)	12.45 (11.78-13.28)	-	-	-	98.0 (76.5-150.0)

Abbreviations: Pu: pituitary tumor; Pa: pancreas tumor; Th: thyroid tumor; Ad: adrenal tumor; NA: no applicable; Th*: medullary thyroid cancer in patient's sister; Ad*: adrenal tumor in patient's brother; SP: subtotal parathyroidectomy; TP: total parathyroidectomy with forearm autograft; CI: confidence interval; IQR: interquartile range 25-75%.

gland hyperplasia, three subsequently underwent TP as the primary surgery due to concomitant thyroid abnormalities including papillary cancer (Patient 7), adenoma (Patient 8), and medullary cancer (Patient 9). This resulted in 11 patients finally receiving SP as the primary surgical procedure. The majority of patients showed hyperplasia in over half of the biopsied glands during the initial cervical explorations. Of the 53 parathyroid glands excised from the 14 patients, 37 glands (70%) were found to be hyperplastic.

Recurrence

Of all 14 patients, eight (57%) experienced recurrent hyperparathyroidism after primary surgery. The median follow-up period was 98 months (range, 51 ~ 216 months) (Table 1 and 2). With the exception of one case who had received TP initially and who demonstrated forearm graft recurrence (Patient 7), the seven other patients, who underwent SP as the primary procedure, all had intraoperative histologically-proven recurrence associated with residual tissue in the neck. The median duration between first surgery and recurrence was 79.5 months (range, 32 ~ 127 months). The ten-year recurrence-free rate was 45% (Fig. 1). The cases with recurrence had a preoperative iPTH level of 135 pg/mL (range, 85 ~ 241) and calcium levels of 12.55 mg/dL (range, 10.9 ~ 13.3) before re-operation.

Remedial surgery for recurrence

As for preoperative localization, a sestamibi

Table 2. Recurrence of Hyperparathyroidism

Patient No.	Recurrence-free interval (months)	Pre-2nd op iPTH (pg/mL)	Pre-2nd op Ca (mg/dL)	Reoperative procedure	Weight of excised gland (gm)	Post-op complication	3-month iPTH* (pg/mL)	3-month Ca* (mg/dL)
1	40	195	13.0	TP	2.1	T,L	98	9.3
3	127	140	11.8	TP	0.99	T,L	72	8.5
4	64	95	10.9	TP	1.25	T	60	7.5
5	32	110	12.7	TP	0.56	L	68	8.1
7	95	85	13.1	GE	0.8	T	22	9.1
11	99	241	12.4	TP	1.89	T	120	8.9
12	111	130	13.3	TP	1.61	T	79	9.2
14	59	175	11.5	TP	2.7	T,L	47	7.6
Mean (95% CI)	78.3 (49.5-107.2)	146.3 (101.4-191.2)	12.3 (11.6-13.0)	-	1.48 (0.88-2.09)	-	70.7† (45.6-95.8)	8.5‡ (7.9-9.1)
Median (IQR)	79.5 (44.7-108.0)	135.0 (98.7-90.0)	12.5 (11.6-13.1)	-	1.43 (0.85-2.05)	-	70.0 (50.3-93.3)	8.7 (7.7-9.2)

Abbreviations: T: transient postoperative hypocalcemia; L: recurrent laryngeal nerve palsy; CI: confidence interval; IQR: interquartile range 25-75%; TP: total parathyroidectomy with forearm autograft; GE: forearm graft excision; *: Significantly different from respective values before second operations (both $p = 0.008$, Wilcoxon signed rank test); †: Mean post- reoperative reduction in serum iPTH levels: 75.6 pg/mL (95% CI: 45.9-105.4); ‡: Mean post- reoperative reduction in serum calcium levels: 3.8 mg/dL (95% CI: 3.5-4.2).

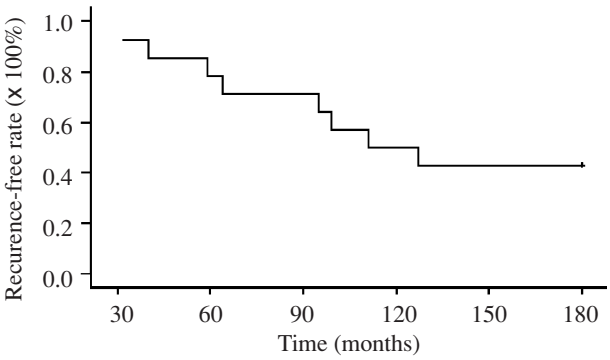

Fig. 1 Kaplan-Meier analysis of the recurrence-free rate of patients following initial parathyroidectomy. Note that the rate was 45% at 10 years.

scan was adopted as the first imaging study and this demonstrated recurrence in seven of the eight glands in the neck and one over the forearm (Patient 7). CT scans of the neck, which were the second-line pre-reoperative imaging modality, also showed seven glands in situ for each case with neck recurrence. The true positive predictive values were 100% for sestamibi scan and neck CT in our series. Except for Patient 7, who underwent forearm graft partial excision, the remaining seven patients all received neck re-exploration for recurrence as the re-operative procedure. Glands weighing from 0.56 to 2.7 gm (median: 1.43 gm) were identified and excised in these eight patients by a second operation (Table 2). Two of the eight patients (Patient 1 and 12), who experienced recurrence after initial SP and subsequently had received TP as the second operation procedure, still developed forearm implantation site graft recurrences. These recurrences were then successfully treated surgically under local anesthesia.

Operative complications

Among the 14 patients having undergone first surgery, two (14%; Patient 6 and 7) sustained temporary postoperative hypocalcemia. On the other hand, of the eight patients who received a second operation, all except one individual (Patient 5) (87.5%) exhibited this condition (Table 2). All hypocalcemic patients received oral calcium and vitamin D3 supplementation. Severe hypocalcemic tetany episodes

were treated by intravenous calcium infusions during hospitalization. Among the eight recurrence cases, Patients 4 and 14 had persistent hypocalcemia requiring long-term calcium and vitamin D_3 supplementation, which lasted for more than one year. Persistent postoperative hypoparathyroidism was noted in one patient (Patient 14) (12.5%) who refused graft implantation and required calcium carbonate supplementation for persistent hand numbness. No patient received cryopreserved parathyroid implantation due to intractable hypocalcemia during the follow-up period.

Among the seven in situ recurrent cases after second neck explorations (Table 2), four (57%) had postoperative temporary recurrent laryngeal nerve palsy resulting in hoarseness and choking that subsided within months after surgery. Overall, the results indicate a significantly higher percentage of complications after second neck exploration (100%) compared with the first (14%) ($p = 0.002$) (Table 3).

Overall outcomes

Three months after the second operation (Table 2), the serum levels of iPTH and calcium had dropped from 135 pg/dL (range, 85 - 241) and 12.5 mg/dL (range, 10.9 – 13.3) pre-operatively to 70 pg/dL (range, 22 - 120) and 8.7 mg/dL (range, 7.5 - 9.3) after the re-operations, respectively (both $p = 0.008$). The post operative improvement difference in serum iPTH and calcium levels was (135 vs 70 pg/mL, 75.6 [95% CI 45.9-105.4] pg/mL) and (12.5 vs 8.7 mg/dL, 3.8 [95% CI 3.5-4.2] mg/dL), respectively (Table 2). Of the eight patients who had undergone a second exploration for disease recurrence, two (Patient 1 and 12) (25%) experienced forearm graft recurrence 14 and 23 months after neck re-exploration, respectively. While Patient 1 showed no further evidence of disease recurrence after the third operation, Patient 12 still had a second forearm graft recurrence 16 months after the third forearm surgery and required a fourth operation for partial forearm graft excision before attaining an eucalcemic status. There were two mortalities in the current study (Patients 1 and 13); these were attributable to pituitary tumor surgery-related complications (Patient 1) and end-stage renal disease-related morbidity from diabetic nephropathy (Patient 13) and occurred 6.3 and 8.5 years after primary surgery, respectively.

DISCUSSION

To date, surgery remains the treatment of choice for parathyroid hyperplasia. The success rate is influenced by different factors, including preoperative diagnosis, the surgeon's experience, optimal surgical timing, and the availability of intraoperative diagnostic tools; overall, the selection of the appropriate surgical strategy is the most crucial factor that accounts for the discrepancies in treatment outcomes at different centers. Various surgical approaches for different familial disorders have been proposed.[7,8,10] The standard procedure should include thymectomy due to the high incidence of supernumerary or ectoptic parathyroid glands in the thymus.[5,9] Although there has been copious studies endorsing the application of each surgical strategy, the optimal approach remains controversial despite recent advances in radiographic imaging and anesthesia.

Since most surgeons believe that permanent hypoparathyroidism is worse than mild hyperparathyroidism in terms of symptom occurrence; therefore SP has been recommended as the initial surgical approach for the treatment of primary parathyroid hyperplasia on the basis that it will

Table 3. Rate of Complications after Surgery involving Neck Explorations

Complication	1st surgery (N = 14)	2nd neck exploration (N = 7)	*p* value*
Temporary nerve palsy	0	4 (57%)	0.006
Neck exploration for hemostasis	0	0	–
Transient post-op hypocalcemia	2 (14%)	6 (85%)	0.003
Permanent hypocalcemia	0	1 (14%)	0.0389
Overall	2 (14%)	7 (100%)	0.002

*: Results of Fisher-exact test.

reduce the incidence of postoperative hypoparathyroidism. TP is reserved only for recurrent cases.[14] Accordingly, such a strategy was adopted in the past for our series. However, the results of this study revealed a high rate of post-SP disease recurrence that required subsequent re-exploration(s), which suggests a justification of TP as the initial treatment strategy. The comparatively high recurrence rate in our series may be due to the relatively small sample size. On the other hand, since most patients (except Patient 4) with disease recurrence in our series had all the four parathyroid glands identified, another cause of disease recurrence in our series may be incomplete resectioning of the supernumerary glands that has been reported in 30% to 37% of patients with hyperparathyroidism.[5,9,15,16] However, this was unlikely because we performed routine central neck compartment dissection and transcervical thymectomy as well as the identification of abnormal glands in all patients during cervical re-exploration.

Although the causes of recurrent hyperparathyroidism after SP are variable, including the presence of ectopic, supernumerary, and missed glands, local seeding of a ruptured gland during operation, as well as recurrence in the grafted tissue, we propose in our series that usually the condition arose from glandular remnants in the neck following SP. The recurrence may be attributable to abnormal tissue that is left behind initially or transformation of "normal" residual tissue after exposure to unfavorable extrinsic or genetic components.[17,18] Consequently, the high rate of recurrence would seem to be an unavoidable feature of this multiple gland disease due to a strong genetic component. Therefore, surgery for multiple gland disease should be viewed as only a palliative procedure instead of a one-stage operation.

Furthermore, neck scarring and anatomical distortion usually contribute to morbidities during neck re-explorations and this could be avoided if TP was used initially. In addition, not only do neck re-operations have a lower cure rates (80%-90%), but they also take longer to perform, and cost significantly (2-3 times) more than the initial operations.[16] Other than transient hypocalcemia, the associated morbidities included permanent recurrent laryngeal nerve damage and permanent hypocalcemia, which impose challenges for both the endocrine surgeon and the patients. According to Profanter et al.,[19] the incidence of recurrent laryngeal nerve damage was 29.4% in one series (persistent nerve damage, 11.8%) after parathyroidectomy in patients with prior thyroid surgery despite preoperative image localization. Additionally, the results of other studies[20,21] have also showed a high incidence of permanent recurrent laryngeal nerve injury and severe hypocalcemia, 1.2% to 4% and 1.2% to 25.3%, respectively, in patients with repeated cervical operations. Although neither permanent recurrent laryngeal nerve injury nor severe hypocalcemia require graft re-implantation after neck re-exploration were evident in our series, temporary nerve palsy and transient hypocalcemia requiring calcium supplement were still noted in 50% and 75% of the cases in our series, respectively, after the second neck exploration.

Consistent with the experience from other authors,[4-6,14] our results showed that recurrent hyperparathyroidism occurred in 7 out of 14 patients (50%) over the 98 months follow-up in this series, suggesting that the application of SP to the treatment of multiple gland disease of PHPT just has a high likelihood of recurrence when there is long-term follow-up. Moreover, patients with persistent hyperparathyroidism are at risk of bone loss, nephrolithisasis, cardiovascular disease, neurobehavioral impairment and an associated diminished quality of life, especially after inadequate initial surgery[22] that requires neck re-exploration with high risk of complications as mentioned above. Our experience with TP in patients with secondary hyperparathyroidism has demonstrated the feasibility of TP as the initial surgical strategy in terms of the absence of intractable postoperative hypocalcemia and an acceptable rate of disease recurrence.[12] Therefore, TP seems to be the appropriate initial surgical option for multiple gland hyperplasia; it can achieve a comparable initial cure rate while avoiding the morbidities from neck re-explorations.

To overcome the shortcomings of TP, including the possibility of graft failure and difficulty in locating recurrence sites, that is cervical vs. forearm, appropriate strategies can be adopted. Since cryopreserved tissue remains functional despite several years of storage with a graft failure rate of only 5 percent or less,[23] cryopreservation of parathyroid tissue needs to become a routine practice to protect against possible post-TP graft failure. Furthermore, the Casanova test[13] and a sestamibi scan[24,25] can effec-

tively differentiate the location of any disease recurrence. We have previously reported a successful recurrence site determination through a combination of Casanova test, sestamibi scan, forearm palpation, and CT scan, which, together with meticulous surgical exploration, can achieve a subsequent satisfactory surgical treatment for disease recurrence after TP for secondary hyperparathyroidism.[12,25] Jugular vein iPTH sampling has been proposed as a effective means of glandular localization when there is failure of all non-invasive measurements, but this approach necessitates an invasive procedure, namely selective venous catheterization for blood sampling. Moreover, although it allows the rapid intra-operative determination of successful parathyroidectomy when combined with a quick iPTH assay,[26] the associated cost precluded its routine use at our institute.

Taken together, the results of the present study showed that the incidence of permanent hypoparathyroidism after TP in this series (1 out of 10 patients, 10%) was not different from that reported in other SP surveys, whereas the incidence of recurrent hyperparathyroidism after initial SP in this study (7 out of 11 patients, 64%) was higher than that reported in the literature.[7-10] Therefore, we recommend the use of TP as initial surgery in order to simplify any future re-operation by minimizing the risk of cervical re-exploration because of the high recurrence nature of this disease entity.

This study has two major limitations. Firstly, the series is relatively small so that a strong tangible conclusion can not be fully drawn. Secondly, since genetic confirmation of endocrine diseases was unavailable at our institute, the genetic traits are questionable in some of our cases who have suspicious familial diseases.

In conclusion, since TP and SP are both acceptable surgical procedures for multiple gland hyperplasia of PHPT, the basis of any choice mainly lies on the surgeon's experience and the resources available. The results of the current study demonstrated that, compared with SP, TP has a similar incidence of postoperative hypocalcemia and a equivalent initial success rate but has the distinct advantage of avoiding the complications of neck re-exploration as well as simplifying the management of graft recurrence. This suggests that TP is the preferable strategy in the initial surgical treatment of hyperplasia of PHPT.

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副甲狀腺切除術在治療原發性副甲狀腺增生的經驗

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背 景： 副甲狀腺全切除併前臂自體移植術以及次全切除術是兩種主要用來治療原發性副甲狀腺增生的術式。雖然前者被認爲會增加術後永久性副甲狀腺功能低下以及自體移植處復發的風險，仍然是不少外科醫師的優先選擇。這篇回溯性的文章主要在評估對原發性副甲狀腺增生第一次手術即行副甲狀腺全切除併自體移植的可行性。

方 法： 收集自 1987 到 2007 年因爲原發性副甲狀腺增生而接受副甲狀腺切除的病人作回顧。共使用兩種術式，原則上第一次先採次全切除 (三又二分之一) 爲標準術式，當術後復發或一開始同時合併甲狀腺疾病時則採全切除併自體移植術式。

結 果： 總共有 14 名患者平均追蹤 98 個月 (51 到 216 個月)。這些患者有 11 名接受次全切除及 3 名接受全切除手術。這 11 名次全切除患者有 7 名 (63%) 發生術後的復發，而這 7 名復發的患者均接受頸部的再手術，術後有 6 名 (87%) 發生了暫時性低血鈣，4 名 (55%) 發生喉返神經麻痺。整個的頸部因第二次手術產生併發症比率有意義的高過第一次手術。有 3 名患者第一次即接受全切除併自體移植手術，而其中有一名發生植入部位復發。全部共 8 名患者因復發而接受再次手術，而且再次手術後血清中的鈣離子 (從 12.55 mg/dL 到 8.7 mg/dL) 及副甲狀腺素濃度 (從 135 pg/mL 到 70 pg/mL) 均有改善，十年的疾病無復發率爲百分之四十五。

結 論： 對於原發性副甲狀腺增生，儘管第一次就做確實的手術，之後也常會因復發而需要再次手術，行次全切除後復發而再次手術產生併發症的比率比一開始即行全切除明顯的提高，因此我們推薦第一次即選擇全切除手術較適合。

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關鍵詞： 副甲狀腺增生，副甲狀腺全切除術，副甲狀腺次全切除術，自體移植

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