SCOTTISH NATIONAL OBSTETRIC BRACHIAL PLEXUS INJURY SERVICE

ANNUAL REPORT 2012-13

Greater Glasgow & Clyde
Health Board

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The completed Annual Report should be sent electronically by 31 May to:

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Section A : Service/Programme

A2 Aim / Purpose / Mission Statement / Date of Designation

The Paediatric Brachial Plexus Injury Service, based at the Royal Hospital for Sick Children, Glasgow and became a designated National Service in April 2006.

It provides an integrated multidisciplinary service for obstetric brachial plexus injury, traumatic brachial plexus injury and tumours involving the brachial plexus including:

- **Diagnosis:** Clinical, MRI, Ultrasound, Neurophysiology.
- **Surgery:** Early surgical exploration and nerve repair
  Secondary reconstruction for shoulder and other deformities
- **Physiotherapy**
- **Occupational Therapy**

A3 Description of Patient Pathway

A3 a) Target Group for Service or Programme

Children with obstetric brachial plexus injury are the main group managed by the service. When necessary children with traumatic brachial plexus injury or tumours involving the brachial plexus are seen.

A3 b) Abbreviated Care Pathway for Service or Programme

The service receives referrals from maternity units nationally, paediatricians and local orthopaedic services. Along with their parents, Children with obstetric brachial plexus injury (OBPI) are assessed in the outpatient clinic by medical staff and therapists to confirm the diagnosis, exclude immediate complications (e.g. shoulder dislocation), and to establish a likely prognosis. Some children are seen prior to this first clinical review by the specialist therapists, and receive instruction on therapeutic exercises. A management plan is formulated that includes parental counselling, ongoing physiotherapy, occupational therapy input (regarding positioning & handling, and sensorimotor development), investigations when necessary, and monitoring of progress. Surgical decisions on nerve surgery and prophylactic shoulder interventions are made around 3 months of age, and on secondary surgery (shoulder procedures, hand reanimation, functional muscle transfers) as necessary during growth.

Surgery is carried out for:

- Exploration and surgical repair of the brachial plexus nerves, in a small number of children with more severe lesions who have inadequate motor recovery at 3 to 6 months of age.
- The prevention of more severe shoulder abnormalities by early conservative interventions (e.g. casting, botox injections).
- Joint releases, tendon transfers, bony procedures and free functioning muscle transfers for upper limb deformities resulting from OBPI. These most commonly affect the shoulder.

Children with persisting deficit are followed up in outpatients at least until skeletal maturity.

B1 Efficient

B1 a) Report of Actual v Planned activity

Statement of Activity 2012-13

		Actual	Agreed
Assessment		46	35
Tertiary new outpatient referrals		33	25
Admission for surgery	nerve, other	8	[redacted]
ITU bed days		0	
HDU bed days		0	
Ward bed days	1(dsu)	27	
Outpatient follow up appointments		193	

NHS Board of residence for referrals:	Ayrshire and Arran	[redacted]
	Dumfries and Galloway	[redacted]
GG&Clyde patients	Greater Glasgow & Clyde	31
(13 patients seen less than 3 times & discharged)	*GGHB& Clyde tertiary*	18
	Forth Valley	[redacted]
	Lanarkshire	[redacted]
	Lothian	[redacted]
	Tayside	[redacted]
	Western Isles	[redacted]
		46
Total tertiary referrals		33

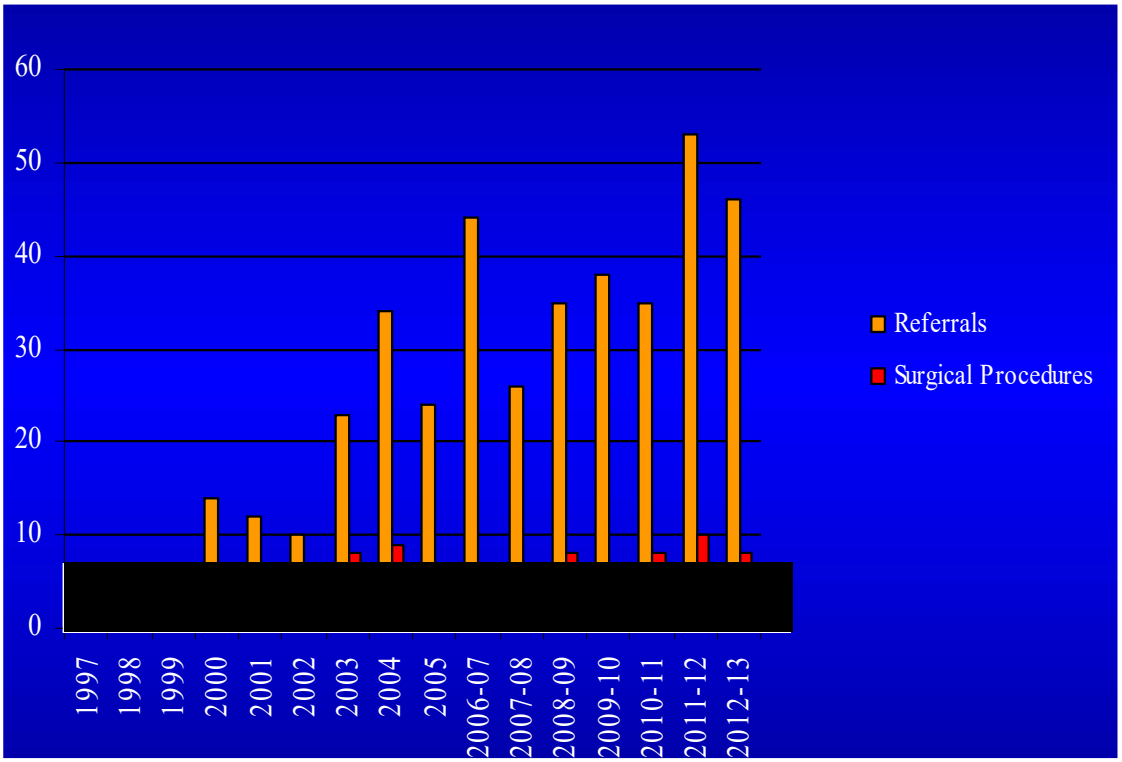
NHS Board of residence for admissions:	Ayrshire & Arran	[redacted]
	Greater Glasgow & Clyde	6
		[redacted]

NHS Board of residence for outpatient appointments:	Ayrshire and Arran	15
	Borders	[redacted]
	Dumfries and Galloway	
	Fife	8
	Forth Valley	11
	Greater Glasgow & Clyde	95
	Grampian	[redacted]
	Highland	
	Lanarkshire	23
	Lothian	22
	Tayside	6
	Western Isles	[redacted]
		193

Referrals and Operation Numbers since 1997:

Year	Referrals	Tertiary Referrals	Surgical Procedures
1997	6	6	[redacted]
1998	[redacted]	[redacted]	[redacted]
1999	[redacted]	[redacted]	0
2000	14	14	[redacted]
2001	12	12	[redacted]
2002*	10	10	[redacted]
2003	23	23	8
2004	34	34	9
2005	24	24	[redacted]
2006 - 07	44	44	6
2007- 08	39	26	[redacted]
2008 - 09	40	36	8
2009 - 10	38	25	7
2010 - 11	35	26	8
11-12	53	28	10
12-13	46	33	8
Total	**426**	**349**	**65**

Activity Graph



B1 b) Resource use

Covered in other parts of the report.

B1 c) Finance and Workforce

NHS Greater Glasgow & Clyde - Women & Children's Directorate

Obstetric Brachial Plexus – Financial Report For 12 Month Ending 31st Mar 2013

	Full year funded value of agreement	Twelve Month funded value of agreement	Actual outturn as at 31st Mar 2013	Variance
	£	£	£	£
FIXED				
Nursing/PAM	66,300	66,300	66,300	0
Medical	9,975	9,975	9,975	0
Other direct	30,198	30,198	30,198	0
Indirect	15,146	15,146	15,364	-218
Capital charges	58	58	58	0
Total Fixed	121,677	121,677	121,895	-218
VARIABLE				
Pharmacy	5,118	5,118	2,614	2,504
Travel & Training	2,144	2,144	1,095	1,049
Total Variable	7,262	7,262	3,709	3,553
TOTAL	128,939	128,939	125,604	3,335

B1 d) Key Performance Indicators (KPIs) and HEAT targets

No KPIs agreed.

B2 Effective

B2 a) Clinical Audit Programme

Physiotherapy

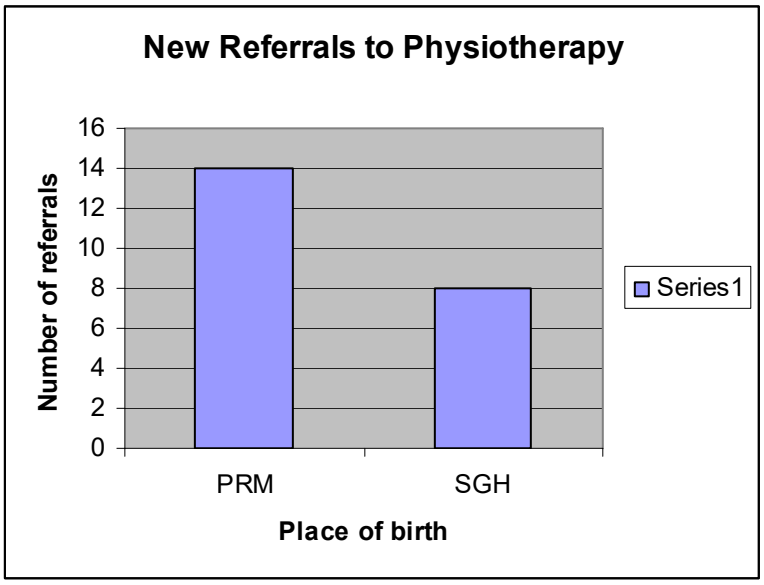
The Obstetric Brachial Plexus Palsy (OBPP) Specialist Physiotherapist, Heather Farish, continues to attend all clinics to offer physiotherapy assessment, advice and treatment to patients who require it as well as liaising with community physiotherapists across Scotland regarding their patients who attend the clinic. Follow up appointments for patients who live in Glasgow and not currently receiving ongoing physiotherapy are given at times when required especially during growth spurts and if they are developing pain.

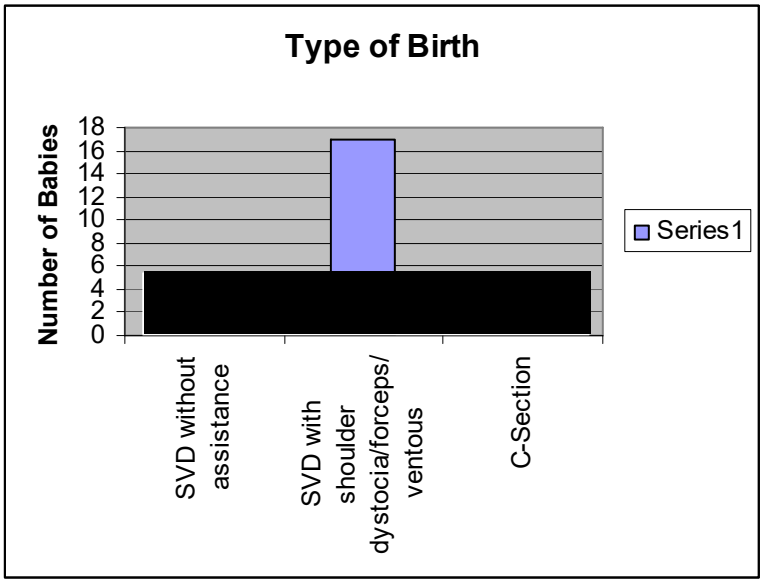
A referral pathway has been set up with the Glasgow maternity hospitals to ensure that we see all new babies born with an OBPP. On most occasions physiotherapy is the first point of contact for the family after discharge from the maternity hospital and therefore time is spent at the first appointment explaining what OBPP is and answering any questions the family have. Whenever possible babies are seen within 10 days of birth to ensure passive range of movement is maintained to prevent posterior subluxation/dislocation of the shoulder. This ensures unnecessary shoulder surgery is prevented. Advice is given on handling and positioning of the arm as well as sensory stimulation. Assessment is made for neglect of the affected arm and if appropriate advice is given the parents on head and neck positioning to avoid any associated plagiocephaly developing. Heather reviews new babies regularly in the initial period to monitor any changes and can feedback to the rest of the team prior to their clinic appointment.

Audit

In 2012 there were 22 new babies referred to physiotherapy with an Obstetric Brachial Plexus Palsy. Of these 22 babies there were [redacted] who did not regain biceps recovery by 3-4 months and went on to have nerve surgery.

The following graphs give a summary of the audit.





Trends in surgical procedures

There were 8 procedures carried out during the year, which break down as follows:

[redacted] were explorations of the brachial plexus nerves with nerve grafting. The outcomes of nerve repair procedures continue to be closely audited as detailed in the 2011-12 report.

[redacted] patients had manipulation of the shoulder and Botox injections to relax contracted muscles. We are monitoring the efficacy of these procedures.

[redacted] child had open release of muscles at the shoulder and reduction of dislocation. This represents a reduction in requirement for this type of surgery compared with previous years. The indications for the surgery have not substantially changed, so the reasons for this trend are not clear. It is possible that earlier physiotherapy/surgical intervention is reducing the number of children with shoulder contractures severe enough to warrant surgery.

[redacted] had a free muscle transfer to strengthen elbow flexion. This type of later reconstruction has been an important addition to the reconstructive options offered by the service since Professor Hart, Plastic Surgeon joined the team.

[redacted] had a plate, inserted at an earlier osteotomy procedure, removed.

[redacted] had resection of a sarcoma involving the brachial plexus. The procedure was carried out in conjunction with the Orthopaedic Bone and Soft Tissue Tumour Service.

B2 b) Clinical Outcomes/ complication rates / external benchmarking

Covered in other parts of the report.

B2 c) Service Improvement

Occupational Therapy

Following agreement by NSD to fund 0.3 WTE for Occupational Therapy, Nicky Hart was recruited and has commenced involvement in the paediatric service at Yorkhill hospital.

The role of OT since attending the clinic has been to be involved in the multidisciplinary team in the clinic setting.

Reasons for Referral to OT:

Functional upper limb assessments
ADL/ PADL/ DADL assessments
Play development
Provide strategies and advice

Treatments:

Initial out-patient assessments at Yorkhill.
Provide advice to nurseries and schools particularly at transition times (nursery to school and primary to secondary).
Liaison with social work departments regarding any home adaptations.
Liaison with community OT's out with GG&C.
Provision of small pieces of ADL equipment for home and link with education.
Provision of therapeutic activities and exercises, eg, theraputty.
Provide strategies and advice to older school age children.
Attend outpatient clinic in conjunction with surgeons to assess and provide advice at the appointment.

Future Plans:

OT to be involved in younger age group to provide advice regarding sensory play and positioning.

To be more involved with Physiotherapy colleagues regarding exercises and how these can be incorporated into everyday activities.

Physiotherapy

During 2012 Heather Farish has updated the referral guidelines for the maternity hospitals to ensure that all babies born with an OBPP are referred to physiotherapy on discharge from the maternity hospital. This was done to highlight the importance of physiotherapy in the early stages prior to their clinic appointment and to ensure we could offer all babies an appointment with 7-10 days after birth. It is planned to further increase communication with maternity units across Scotland.

With the appointment of an Occupational Therapist for the service it is hoped that over the coming year physiotherapy can work jointly with occupational therapy for certain patients who would benefit from a joint approach.

Young Adult Clinic

Some patients who are still followed up in the children's brachial plexus clinic are now age 16 or over. In addition some referrals are received for adults who have ongoing problems resulting from OBPI. It was felt inappropriate to continue to see these patients in the children's clinic. Therefore a new clinic for young adults has been started the first being held in April 2011. The clinic is at the New Victoria Hospital, Glasgow, the same location as the adult brachial plexus clinics. The clinical nurse specialist, occupational therapist, and physiotherapist who work with the adult service are contributing. The clinic is continuing on a twice yearly basis.

B2 d) Research

Tim Hems

During the year a paper presenting the results of a long standing project on the outcome of surgery for shoulder deformity in OBPI was published.
Based on this experience, Tim Hems was invited to give a lecture entitled, "Internal rotation deficit after surgery for internal rotation contracture of the shoulder in obstetric brachial plexus injury," at the Congress of the International Federation of Societies for Surgery of the Hand held in Delhi, India. (7th March 2013).

Tim Hems with Terence Savaridas (Specialist registrar in Orthopaedics) have continued a project to quantify elbow flexion strength in children who have had obstetric brachial plexus injury (OBPI). Although it is known that elbow flexion usually recovers to a functionally useful level after OBPI this has not be formally quantified.
The study involves measuring elbow flexion strength in children over the age of 5 attending the outpatient clinic using a hand held dynamometer. Ethical approval has been obtained. Data collection has been completed and we are moving on to analysis.

Publications

Sibinski M, Hems,T.E.J., Sherlock DA. Management strategies for shoulder reconstruction in obstetric brachial plexus injury, with special reference to loss of internal rotation after surgery. *Journal of Hand Surgery:European Volume*, 2012, 37E , 772-779.

Andy Hart

During the year 2012-2013 Prof. Hart has been engaged with the following research work of direct relevance to brachial plexus injury:

- Psychological impact of obstetric brachial plexus injury (OBPI) – a junior surgical fellow has now received NRES approval to commence a planned project that will utilize validated psychological scales to assess two elements of relating the OBPI. These will be applied over the next 18 months to accrue a sufficient dataset for analysis:
    - To investigate the parental response to the diagnosis of their child with OBPI, the information presented to them, and the timing of various investigations & interactions with healthcare workers.
    - To investigate the impact of OBPI upon a child's psychosocial and psychosexual development (body image, social confidence, etc.)

- University of Glasgow:
    - "**Electro-active nano-patterned construct with integral solenoid activity for nerve reconstruction**" (Aug 2009 – Oct 2013, Stephen Forrest Trust, £200K) I have two linked PhD projects ongoing (now in their final year) which investigate the role of surface topography (micro- & nanoscale) and bioelectronic stimulation upon the regenerative profile of peripheral nerve repair constructs. Both projects are progressing well towards conclusion, and initial work has been presented internationally. Spin-off projects for several MRes students have been generated.

- **CrackIt DRGnet Phase 1** (Dec 2012 – June 2013, MRC / NC3Rs £100K grant over 6 months) this is to establish a legal, ethical, and viable system for the provision of human sensory neurons (DRG origin) for use across Europe by researchers developing pain medications, including those to treat nerve injury
- RCSEd Small Grant Award (£10K): examining the intracellular effect upon regeneration associated gene activity of different polymer substrates & surfaces for use in nerve repair constructs. This work will help a plastic surgery trainee build her case for full time PhD funding, and grant submissions to Wellcome are in process.
- I have three part-time surgical research fellows.
  - one is focused upon the CrackIt grant
  - one is focused upon the extraction of adipose-derived stem cells (ADSC) & stromal vascular fraction (SVF) for use in peripheral nerve regenerative medicine
- Anatomy of the suprascapular nerve: dissection & radiological investigation of anatomy as pertains to brachial plexus injury & reconstruction – this small scale study was undertaken by a medical student, and is being written up this year.

- Collaborative research group
  - I maintain links with colleagues in the Universities of Umea (Sweden) & Manchester that focus on peripheral nerve repair (tissue engineering, neuronal protection, adjuvant pharmacotherapy, timing of nerve repair). A multicentre clinical trial of neuroprotective pharmacotherapy in major nerve injury is under development.
  - Output has included the first clinical studies to validate the use of volumetric MRI as a measure of nerve injury induced neuronal death, and to demonstrate the neuroprotective benefit of early nerve repair in major nerve injury.

Presentations of Direct Relevance to Brachial Plexus Service

1. "Peripheral nerve injury" MRC trauma reconstruction workshop, Birmingham 2012
2. "Reconstruction of major peripheral nerve injury - clinical options and neurobiological research strategies" Glasgow Royal Infirmary Grand Round 24th April 2013
3. "Cadaver investigation of the functional anconeus free flap for thenar reconstruction" Ng ZY, Mitchell JH, Fogg Q, Hart A. 2012 Annual Meeting of the American Association for Hand Surgery

Publications of Direct Relevance to Brachial Plexus Service

1. Reid A., Terrenghi G., Wiberg M. & Hart A "Pharmacological Treatment as an Adjunct to Surgical Procedures in Nerve Injury" Federation of European Societies for Surgery of the Hand instructional course book 2013
2. "Report of the MRC trauma Reconstruction Workshop 2012" Hart A et al 2012: In this report reviewing the whole of reconstructive biological and surgical research (subsequent to a 2 day expert panel workshop with >40 invited delegates), the case for brachial plexus injury research to have primacy was clearly accepted by the workshop group, and was made to the MRC, as it frames its forthcoming round of major trauma grant calls.
3. West C, Hart AM, Terenghi G, Wiberg M "Sensory Neurons of the Human Brachial Plexus: A Quantitative Study Employing Optical Fractionation and In-Vivo Volumetric Magnetic Resonance Imaging" Neurosurgery 2012 May;70(5):1183-94 [I.F. 2.785]
4. Chin K., Vasdeki D., Hart A. "Inverted Free Functional Gracilis Muscle Transfer for the Restoration of Elbow Flexion" Journal of Plastic, Reconstructive & Aesthetic Surgery 2013;66:144-146

5. Ng Z., Mitchell JH, Fogg Q., & Hart A.M. "Functional Anconeus Free Flap for Thenar Reconstruction: A Cadaveric Study." Hand 2012
6. Terenghi G, Hart AM & Wiberg M "The nerve injury and the dying neurons: diagnosis & prevention" JHS(European) 2011 Nov;36(9):730-4 [IF 1.093]

Honorary & other Appointments received 2012-2013 in reflection of neurobiological research activity:

Senior Research Associate, Centre for Cell Engineering, University of Glasgow 2012
Chair, The MRC Trauma Reconstruction Workshop Group
Educational lead, Canniesburn Plastic Surgery PSU
Scientific advisor to organising committee, ESPRAS Meeting 2014
Scientific advisor to organising committee, EURAPS Meeting 2015
Member, British Association of Plastic Reconstructive & Aesthetic Surgeons Academic Group, 2012 onwards
NICE adviser on the assessment of Phrenic Nerve Transfer for use in brachial plexus injury reconstruction

B3 Safe

B3 a) Risk Register

All healthcare professionals funded within the structure of the Obstetric Brachial Plexus Palsy Service meet Greater Glasgow & Clyde Trust requirements for vetting by Disclosure Scotland, and registration with the Information Commissioner's Office.
Miss Claire Murnaghan has certified level 3 Child Protection training.

B3 b) Clinical Governance

Patients reviewed, or treated at the RHSC Yorkhill site fall under the hospital's own governance system, reinforced by internal audit within the Orthopaedic, and the Plastic Surgery Services. No significant governance issues have been identified through these mechanisms during 2012-2013.

B3 c) Healthcare Associated Infection (HAI) and Scottish Patient Safety Programme (SPSP)

The outpatient clinic has fully adopted recommendations on hand hygiene, dress code, and cleaning of equipment as recommended nationally. These measures are also in full implementation within the inpatient ward, and theatre complex used. Regular monitoring of compliance within the hospital is performed by assessors independent to the Plexus Service. No peri-operative bacterial infections occurred during the period 2012-2013.

B 3 d) Adverse Events

The service uses existing Greater Glasgow & Clyde thresholds for instigation of adverse event reporting and investigation, plus online reporting systems. No adverse events have been reported to occur during the period 2012-2013.

B 3 e) Complaints / Compliments

Complaints are handled by the Complaints Liaison Officer, as per the NHS Complaints Procedure. Information leaflets regarding the complaints policy are available from any member of staff at RHSC.

B4 Timely (Access)

B4 a) Waiting / Response Times

The mean time between referral and first consultation was 16.1 days (range 0 days to 117 days).

Most referrals are sent centrally Miss Murnaghan at RHSC by letter, fax or via the electronic vetting system for those who are not directly referred by the maternity units.
The urgency of the referral is graded when it is received. The response times have been appropriate to the condition of the patients. The longer delays were as a result of patients not attending the first appointments offered to them.

B4 b) Review of Clinical Pathway

(i) Review and Changes to Clinical Pathway

Insert text here

(ii) Improvements to Local Delivery of Care

Recent education and liaison with maternity units in Greater Glasgow and Clyde and Forth Valley have led to a more stream-lined approach to referral to the Brachial Plexus service, with simultaneous referral to Miss Claire Murnaghan and Miss Heather Farish to ensure that no referral should have a delay in being appointed to the Service, secondary to leave. We have requested that referrals should be made more promptly after birth in order to review the baby soon after birth and ensure that the appropriate information is given to the parents from the outset. As the clinics run on a 3 or 4 weekly basis, patients will be seen as an outpatient in the physiotherapy department in the interim.

B5 Person Centred

B5 a) Patient Carer/Public Involvement

Insert text here

B5 b) Better Together Programme Involvement

Patients and their families benefit from early review by a multidisciplinary team at the Paediatric brachial plexus clinic and are given contact details for our named therapists in order to maintain a close relationship during their treatment. They are given the opportunity to ask questions and find out more information about their diagnosis and are actively involved in the care of the child, particularly through sharing of information and responsibility for exercises and therapy.

B5 c) User Surveys

None performed during the last year.

B6 Equitable

B6 a) Fair for all: Equality & Diversity

The Plexus service complies with NHS rules on equality & diversity in the appointment of staff. Similar care is taken in providing equal care standards to patients and relatives. Appropriate use of interpreters, and awareness of cultural, ethnic and religious practices in regard to examination and interaction with parents is facilitated.

B6 b) Geographical access

Outreach Clinics: In order to assess and follow-up patients from the North East of Scotland a clinics was held at Woodend Hospital, Aberdeen in November 2012. Clinics are held approximately every 6 months depending on demand and seem well received by the patients. Adult brachial plexus patients and children are seen in the same clinic.
The need for clinics in other locations is under review.

Section C : Looking Ahead/Expected Change/Developments

Physiotherapy

Work is in progress on developing a physiotherapy information booklet for the brachial plexus palsy service to give parents a greater understanding of the importance of physiotherapy for their new baby. This booklet will also be available to community physiotherapy staff which will improve consistency of information.

Psychological Support

It is recognised form pilot work, from patient-group feedback, and from international studies that parents and children with OBPI suffer variable levels of psychological morbidity, with many suffering severe morbidity. Children, parents and families will require assessment and targeted support and counselling (when indicated) at various points during their care, most typically at the following times:

1) Around the time of diagnosis assisting parents and families to with bonding, guilt, grief reactions, and interpersonal relationship difficulties. Many parents would benefit form assistance as they learn to manage emotions surrounding shoulder physiotherapy exercises, and again when the child becomes old enough to withdraw co-operation.
2) During the necessary 3 - 6 month period of expectant management until the level of nerve recovery can be stratified a firm prognosis developed, parents & families require assistance managing uncertainty. Should surgery be necessary (eg need for nerve exploration, open reduction of shoulders, botulinum toxin injections) they require significant input relating to the complex decision making process, and then managing their child in cast for ~1 month post-surgery.

3) Pre-school: Therapy should begin the process of teaching the child body awareness, and management of others reactions to their appearance or disability.
4) Starting school: the development of personal body image and the establishment of peer relationships including perception by peers.
5) During adolescence and early psychosexual development
6) In the late teens as career choices are made, and decisions reached about driving and independent living

Currently, some children have been referred to the Department of Clinical Psychology but they have to wait on a common waiting list and so often the time-frame for intervention is longer than appropriate.

There is also an issue with equity of access nationally.

We intend to develop proposals for dedicated professional support for children with OBPI and their families and believe it is important that the person providing this has good knowledge of the condition, and good working relations with the rest of the service.

Patient Information

The previously identified need to revise the parental information pack has been acted upon, but is progressing slower than predicted. Assistance from NSD was offered during the last meeting, and requires integration with the terms of parental information packs required by Yorkhill Hospital. Draft documentation has been prepared and is under review. The current information pack is under review by the hospital FILES committee, prior to being passed to Medical Illustration.

Section D : Summary of Highlights (Celebration and Risk)

Activity levels within the Obstetric Brachial Plexus Injury Service have remained similar to previous years. During the last year important developments have been made in respect of physiotherapy, brachial plexus exploration and repair, ultrasound of the shoulder, development of secondary procedures for forearm rotation, and the young adult clinic. Formal occupational therapy provision has commenced, as has improved outreach interaction with referring services. An increasing number of junior trainees are becoming involved with the service.

The multidisciplinary team remains the basis of the success and ongoing development of the service. As well the work in the clinics, there has been considerable out-patient physiotherapy activity. In addition to those already mentioned in the report operating theatre staff have given skilled assistance in surgical cases.

Appendix

Teaching and Training Activity

Heather Farish, Physiotherapy

In the physiotherapy department we now have 3 band 5 physiotherapists rotating through the different teams. Heather therefore provides teaching on OBPP to the band 5 physiotherapist working within the musculoskeletal team. This includes information on the condition, the OBPP service and assessment and treatment of these babies. As part of their competency document for their rotation they are required to shadow assessments of new babies with OBPP and also come to the clinic.

Heather has also provided teaching on OBPP to the physiotherapists working in Maternity services at the Southern General Hospital. This was to improve their knowledge of OBPP and appropriate early management prior to discharge home from the maternity hospital.

Claire Murnaghan

Talks to:

September 2012	Neonatal Unit Southern General hospital
13th December 2012	Southern General Hospital midwives
20th December 2012	Neonatal unit Princess Royal Maternity hospital, Glasgow
31st January 2013	National Neonatology Study Day (100 UK delegates) at Grand Central Hotel, Glasgow.
12th March 2013	Neonatal unit and Physiotherapists, Forth Valley Hospital.

Tim Hems

24th April 2012	Edinburgh Hand Surgery Course. "Management of Brachial Plexus Injuries". Included OBPI.
23rd November 2012	Scottish Plastic Surgery Training Program and Aberdeen Orthopaedic Training Programme. All day symposium on Traumatic and Obstetric Brachial Plexus Injury, with patient presentations.

Andy Hart

23rd November 2012	Scottish Plastic Surgery Training Programme and Aberdeen Orthopaedic Training Programme. All day symposium on Traumatic and Obstetric Brachial Plexus Injury, with patient presentations.
16th November 2012	University of Glasgow Masters by Research in Cell Engineering – Tissue Engineering & Major Peripheral Nerve Injury.

10th January 2013 Brachial Plexus Injury & The Scottish National Brachial Plexus Surgery Service – presentations to the Orthopaedic Department, and then to the Paediatric Department, Dumfries & Galloway Royal Infirmary.

27th February 2013 Obstetric Brachial Plexus Injury – Occupational Therapy Network Meeting.

Regional Plastic Surgery teaching program - Brachial Plexus Reconstruction, and the response to injury (March 2013).

1 Medical Student Special Study Modules (University of Glasgow student), focusing on brachial plexus reconstruction.