Clinical review

Fortnightly review

Cosmetic surgery

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Cosmetic surgery is a rapidly growing medical specialty both in the numbers of patients treated and in the techniques and approaches available. This review consolidates the information available on cosmetic surgery from popular literature, the media, and advisory services.

Doctors differ in their attitude to surgery for cosmetic reasons only. Patients requesting such surgery are usually normal individuals, but with a heightened consciousness about their looks. A proportion of them may seek advice on what, to them, seems an unsatisfactory appearance. They deserve the same professional approach and empathy as patients seeking help for clinical disorders. I would like to encourage the non-specialist to approach cosmetic surgery objectively. By understanding what may be achieved cosmetically, patients can receive invaluable advice, and appropriate referrals can be organised.

Summary points

- Cosmetic surgery remains highly dependent on the skill of the operator, and technological advance should be viewed with this in mind
- Large volume infiltration can reduce the cost to benefit ratio for selected indications
- Lasers have a relatively limited niche in medical aesthetics
- No single method of breast augmentation has all advantages
- Three surgical procedures can correct facial ageing: resurfacing, subdermal augmentation, and face lift surgery
- Multidisciplinary team work is a practical way to provide a comprehensive service for the patient requiring cosmetic surgery

Methods

This article is based largely on my experience in a multidisciplinary medical team dedicated to aesthetics and health. Recent concepts that have changed the management of patients undergoing cosmetic surgery are incorporated. I have supplemented reviews with articles from high quality journals, and general references are from textbooks.

Extent of cosmetic surgery

Requests for cosmetic surgery can be divided into three categories: correction of abnormal features (eg prominent ears, a large nose, gigantomastia, breast hypoplasia, hirsutism); reversal of the signs of ageing (eg facial wrinkles and creases, thinning hair and baldness, irreversible skin stretching, drooping of prominent tissue such as breasts and buttocks); and treatment of health related problems (eg obesity, tooth decay, abdominal bloating, cellulite, facial fluid retention, chronic skin problems, brittle hair and nails). None of these conditions can be classified as overt clinical disease. Nevertheless, their correction or treatment can significantly enhance patients' self perception and reduce self consciousness.

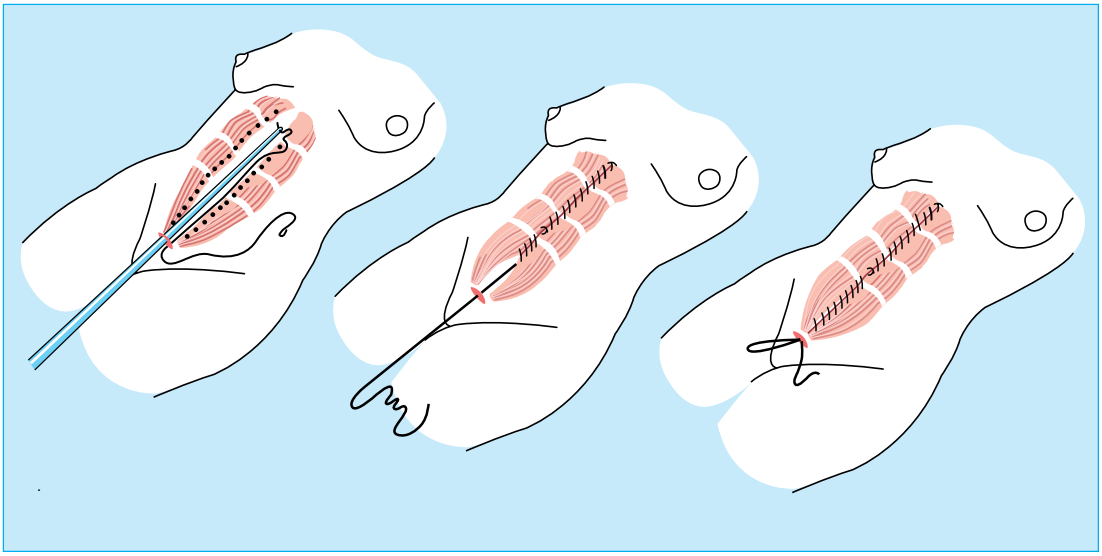
Patients requesting cosmetic surgery are generally well, so surgical risks should be minimal.

Anaesthetic techniques

Recent advances in anaesthetic techniques have reduced the need for general anaesthesia for certain cosmetic procedures, adding to the popularity of cosmetic surgery.[1] Large volumes of dilute local anaesthetic and adrenaline are now used for subcutaneous infiltration, enabling up to 10% of the body surface to be anaesthetised locally and perioperative bleeding to be significantly reduced. Therefore haemodynamic stability can be maintained without intravenous fluid replacement or blood transfusion.[2 3]

Infiltration with a large volume of local anaesthetic furthermore reduces the need for general analgesics. Hypnotics can also be avoided in favour of intravenous sedation for simple procedures, so patients can keep control of their airway and vital functions. Such patients can even be upright during the procedure, and the surgeon can observe the effects of gravity and voluntary muscle activity during surgery.

Minor cosmetic procedures can take place safely under intravenous sedation in the doctor's surgery.[4] For more extensive surgery requiring general anaesthetic or intravenous sedation, hospital remains the best choice.



Endoscopic rectus plication. Reproduced with permission from Bostwick et al [11]

Cosmetic procedures

Liposuction

Aspiration of diet resistant fat is the most popular cosmetic surgical procedure. Requests for liposuction commonly include the abdominal wall, hips, buttocks, thighs, inside of the knees, and the back. Liposuction can also enhance the arms and the contours of the face and neck.

As fat cells do not regenerate in adults, areas undergoing liposuction are generally treated permanently. Increases in body weight after surgery, however, may lead to fat being preferentially deposited in untreated areas. Liposuction for progressive obesity cannot be recommended as a substitute for modification of life style.

Patients with localised fat deposits are best treated at a young age, as the effects of gravity may be difficult to reverse after the third decade.[5]

Originally, liposuction took place under general anaesthesia, using large bore cannulae and no infiltration.[6] This resulted in a bloody operation with inherent sequelae and complications (ecchymosis, haematoma, haemosiderosis, infection[5 6]). Irregularities of body shape were common because of the use of large cannulae and high vacuum suction, and because patients could not cooperate during surgery.[5 7] Substantial fluid loss also limited the amount of fat that could be aspirated.

Currently, about 5 or 6 litres of fluid are infiltrated during an average liposuction.[3 6] The widest cannula used (4 mm diameter) is for deep deposits. The finest aspiration needles of 2 mm or 3 mm diameter are used to treat fat in the immediate subdermal layer. This technique causes little damage to fibrous and nervous tissues and blood and lymph vessels. Postoperatively, the skin has a tendency to firm up towards the deep fascia. Hence scars can often be avoided from the excision of redundant skin. Liposuction is the treatment of choice for fat on the abdomen, back, and buttocks. Even patients with breast hypertrophy can benefit from liposuction, particularly when young.[8]

Modern liposuction techniques depend on the surgeon expending much energy, so methods to reduce physical effort are constantly being developed—for example, devices with an ultrasonic generator at the tip to implode fat cells before aspiration.[6] The device may also reduce the chance of small irregularities.[5–7] Pneumatically driven devices are being developed to reduce operating times and to improve the results in virginal breast hypertrophy, gynaecomastia, tight male fat, and repeat surgeries. Most of these techniques are still controversial, and their future in liposuction is unclear.

Autologous fat transfer

Fat harvested by liposuction can be used to fill hollows and folds. Evidence shows that at least some of this fat survives as a graft.[9 10]

Transferred fat can be used to rejuvenate the face and to contour the body. The procedure needs repeating at least once, but long term results are reasonably predictable.[9]

Endoscopically assisted procedures

It took until the nineties before keyhole surgery could be extended to cosmetic surgery,[11–13] because manufacturers had to design suitable instruments and find ways to create an optic cavity.

Keyhole cosmetic surgery first began with the insertion of inflatable breast implants via the umbilicus.[14] At the same time, endoscopic techniques were developed for plication of abdominal muscle (figure).[11–14] This was soon followed by requests for facial surgery.[13]

Sagging eyebrows and forehead creases can be corrected through keyhole incisions in the scalp. This approach has become the standard for many surgeons, and insights into facial movement have enabled more functional surgery to be performed.[13]

For selected abdominal requests, liposuction can replace traditional abdominoplasty, which leaves a long horizontal scar.[11 12]

Breast implants

Following the controversy over silicone breast implants, the use of any form of silicone gel for breast augmentation is forbidden in the United States and France.[15] This has led to a search for alternative materi-

als,[16] such as a new cohesive form of silicone. The cohesiveness of the filling should reduce the chance of leakage after rupture or puncture. Alternatives to silicone are normal saline, hydrogel, and methylcellulose gel. Regardless of filling used, implants still have a silicone elastomer outer envelope, which acts as an inert interface between the implant and the host.

Surgery for breast augmentation entails the implantation of a foreign body into the subglandular or subpectoral plane. This procedure has several possible sequelae and complications (table1). No one method has all advantages.

Laser surgery

Laser technology has progressed rapidly,[17] although one machine for all indications seems impossible to achieve at this stage. For a centre to cover all indications, at least three or four machines are required. This is often prohibitively expensive.

Red lesions

Red lesions can be treated by a pulsed dye laser with a spectrum of absorption of the colour of haemoglobin.[18] Photothermal energy conversion coagulates the capillaries, which improves the appearance of the lesions. Laser treatment is the method of choice for port wine stains, which respond well if the patient is young. Other superficial vascular lesions can be treated by laser provided the capillaries are not too wide.

Telangiectasia on the legs does not respond to laser treatment. It is still treated by microsclerosis in those patients whose capillaries are wide enough to accommodate a fine needle. I use radiosurgery in patients with capillaries of a small diameter.[19]

Tattoo removal

Tattoos can be removed by laser, which breaks down the ink particles into fragments small enough for macrophages to digest.[20 21] This Q switched (short pulse length) type of laser is only useful for professional tattoos. Traditional excision techniques are reserved for post-traumatic tattoos—that is, embedded dirt from insufficiently cleaned wounds—and amateur tattoos and for residues left after laser treatment.

Skin resurfacing

Removing the top layers of the dermis promotes regeneration of collagen, elastine, and epidermis. This rejuvenates the facial skin long term and improves fine wrinkling. Skin resurfacing can also remove superficial blemishes such as the brown spots of ageing, dilated capillaries, and small keratoses.

Traditional resurfacing methods include chemical peeling and dermabrasion.[22 23] A chemical peel causes a chemical burn. Dermabrasion mechanically removes the epidermis and a variable layer of dermis. Recently, a rapid scanning device has been added to the cutting laser, enabling a predictable depth of skin to be destroyed.[24]

Resurfacing methods treat superficial wrinkles and repair skin aged by light. The results are ultimately dependent on the skill of the operator.

Resurfacing does not help the gravitational descent of facial tissue at subdermal level. Such tissue needs face lift surgery (table 2).

Table 1 Likelihood, on a scale of 1 (non-existant) to 6 (inevitable or maximal0, of outcome after breast augmentation using various implamts

Filling, envelope surface, site	Access	Capsular contraction	Deflation after puncture	Content biodegradable	Mobility abnormality	Gravitational descent of implant	Overriding ptosis of residual breast	Rippling or folding of wall	Size limitations	Muscular distraction of overlying muscle
Cohesive silicone gel										
Textured:										
Prepectoral	Inframammary	3	1	1	6	2	2	1	4	1
Liquid silicone gel										
Textured:										
Prepectoral	Inframammary	4	5	1	6	1	3	2	5	1
Retropectoral	Transaxillary	2	5	1	6	1	4	2	5	4
Smooth:										
Prepectoral	Inframammary, transaxillary, transareolar	2	5	1	6	1	4	1	4	4
Retropectoral	Inframammary, transaxillary, transareolar	5	5	1	6	1	4	1	4	1
Saline implants (inflatable)										
Smooth:										
Prepectoral	Transumbilical	3	6	6	3	4	1	4	2	1
Retropectoral	Inframammary, transaxillary, transareolar	2	6	6	4	4	2	3	3	4
Textured:										
Prepectoral	Transaxillary-inframammary	3	6	6	6	1	3	5	5	1
Retropectoral	Transaxillary-transareolar	2	6	6	6	1	4	4	5	4
Methylcellulose gel										
Prepectoral	Inframammary, transareolar	3	6	6	6	2	3	2	4	1
Retropectoral	Transareolar-transaxillary	2	6	6	5	2	3	2	4	4

1=non-existent; 2=highly unlikely or minimal; 3=uncommon; 4=not uncommon; 5=likely; 6=inevitable or maximal.

Brown lesions

Pulsed dye lasers with the spectrum of absorption of melanin can destroy melanophores responsible for brown lesions.[25] These lasers only work reliably for superficial pigmentation. Unfortunately, they also remove normal pigment, which may result in bleaching of the skin. Most superficial brown spots can be treated by resurfacing, but there is a risk of topical depigmentation.[22 23]

Bloodless incisions

The carbon dioxide laser is a potentially dangerous instrument for the surgeon to use as there is no tactile feedback—that is, with a laser beam the surgeon can see but not feel what is going on.[26] As such, radiosurgery is now gaining popularity, and its radiowaves precisely destroy tissue.[19 26 27]

Hair removal

Although laser depilation is intensively promoted, it is still under development.[28] Often it leads to permanent hair bleaching without affecting hair density long term. Healing problems after laser depilation of the legs are not unknown.

Traditional bleaching and waxing techniques are at this stage unsurpassed for general use. For permanent depilation, radiosurgery is a good alternative for thick and less numerous hairs—for example, on naevi, around the areola, or areas of the face or bikini line.[26]

Injection techniques to combat ageing

Wrinkles and creases indicate ageing. Some of these can be improved by the local injection of materials to support skin.[29]

Bovine collagen—This is used to temporarily fill out superficial wrinkles and deep creases. Antigenic reactions can occur.[30]

Hylan gel—This is a synthetic substance of recent development. It is suitable for fine wrinkles, but its effects are short term.[31]

Permanent materials

Some materials on the market are simple to apply but difficult to remove.[32] Microspheres of polymethylmethacrylate in a collagen matrix, and cristalline silicone, are used for subdermal injection.[33 34 29] Their use is limited to deep folds, depressions, and lip augmentation.

Autologous fat injection—This is a cheap and safe method for facial depressions, lip augmentation, and deep folds.[8 9] It usually needs repeating. The medium term effects are encouraging for most patients.

Botulinum toxin—This selectively paralyses muscles for 3-9 months. It is mainly used to correct glabellar frown lines and occasionally "crow's feet" overlying an over active orbicularis oculi muscle.[35]

Hair restoration

Surgery and prosthetics

Surgery to cover bald areas has moved from the use of punch grafts and flaps that bear hair, "balloon" tissue expansion techniques, or microsurgery to the more reliable technique of micrografting.[36 37]

A strip of scalp is harvested from the occipital area of a donor and divided into individual follicles. These are grafted on to the bald area of the recipient. In some centres a powerful cutting laser is used to burn holes in the recipient's scalp to receive the grafts.[38] There is no proved benefit from using a laser, but there is the potential for damage to existing hair follicles. A natural density of hair growth is achieved after two or three sessions.

The most major advance in hair prosthetics has been the development of a skin glue, which attaches a hair piece for 4-6 weeks.[39] The hair piece can be used in conjunction with micrografting for restoration of frontal hair. The combination of surgery and prosthetics allows for a natural look without limiting hair density.

Table 2 Surgical solutions for facial ageing

Skin layer	Appearance	Surgical solution
Dermis		
Problem:		
Thinning and loss of elasticity	Superficial wrinkles	Resurfacing: chemical, mechanical, laser
Irreversible stretching	Creases, nasolabial folds, eyelid bags, submandibular skin excess	Excision: face lift surgery
Subdermis		
Problem:		
Progressive hypotrophy	Cheek hollow, lip thinning, nasolabial folds	Augmentation: autologous fat transfer, biodegradable substitutes, non-degradable materials
Gravitational descent	Sagging eyebrows, malar bags, nasolabial folds, jowls, platysma descent, witches' chin	Repositioning: face lift surgery

Conclusion

Recently the cost to benefit ratio of cosmetic surgery has decreased substantially (table 3). This is reflected in an ever increasing demand for such treatment. General practitioners may be confronted both with preoperative planning and postoperative care of such patients.

Table 3 Decrease in cost to benefit ratio responsible for increased demand in cosmetic surgery

Benefits	Costs
Increase in:	Decrease in:
Indications	Expenses
Results	Surgical complications
Availability	Scars
Day surgery	Anaesthetic sequelae
Combined procedures	Time off work

Patients requiring cosmetic surgery seek advice from the medical profession, healthcare workers, the media, beauticians, and other patients. A professional interest in cosmetic surgery may serve the public well.

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1 Aston SJ, Beasley RW, Thorne CHM. *Grabb and Smith's plastic surgery,* 5th edn. Philadelphia, PA: Lippincott-Raven, 1997:101.
2 Klein JA. Tumescent technique for local anaesthesia improves safety in large-volume liposuction. *Plast Reconstr Surg* 1993;92:1085-98.
3 Rohrich RJ, Berau SJ, Fodor PB. The role of subcutaneous infiltration in suction-assisted lipoplasty: a review. *Plast Reconstr Surg* 1997;99:1-6.
4 Baker TJ, Gordon HL, Stuzin JM. *Surgical rejuvenation of the face,* 2nd edn. St Louis, MO: Mosby Year Book, 1996:11-44.
5 Dillerud E. Suction lipoplasty: a report on complications, undesired results and patient satisfaction based on 3511 procedures. *Plast Reconstr Surg* 1991:88:239.
6 Zocchi ML. *Advances in plastic and reconstructive surgery.* St Louis, MO: Mosby Year Book, 1995:197-221.
7 Ning Chang K. Surgical correction of post liposuction contour irregularities. *Plast Reconstr Surg* 1994;94:126.

8 Maxwell GP, White DJ. Breast reduction with ultrasound-assisted liposuction. *Operative techniques in plastic and reconstructive surgery*. Philadelphia, PA: Saunders, 1996.
9 Roddi R, Gilbert PM, Vaandrager JM, van der Meulen JCH. The value of microfat injection "lipofilling" in the treatment of soft tissue deformities of the face in Parry-Romberg syndrome. *Eur J Plast Surg* 1994;17:79-83.
10 Coleman WP. Autologous fat transplantation. *Plast Reconstr Surg* 1991;88:736.
11 Bostwick III J, Eaves III F, Nahai F. *Endoscopic plastic surgery*. St Louis, MO: Quality Medical, 1995.
12 Ramirez OM, Daniel RK. *Endoscopic plastic surgery*. New York: Springer-Verlag, 1996.
13 Isse NG. Endoscopic facial rejevenation: endoforehead, the functional lift. *Aesth Plast Surg* 1994;18:21-9.
14 Johnson GW, Christ JE. The endoscopic breast augmentation: the transumbilical insertion of saline-filled breast implants. *Plast Reconstr Surg* 1993;92:801.
15 Cooper C, Dennison E. Do silicone breast implants cause connective tissue disease? *BMJ* 1998;361:403-4.
16 Aston SJ, Beasley RW, Thorne CHM. *Grabb and Smith's plastic surgery*, 5th edn. Philadelphia, PA: Lippincott-Raven, 1997:713-23.
17 Aston SJ, Beasley RW, Thorne CHM. *Grabb and Smith's plastic surgery*, 5th edn. Philadelphia, PA: Lippencott-Raven, 1997:205-19.
18 Achauer BM, Van der Kam VM, Padilla III JF. Clinical experience with the tunable pulsed-dye laser (585 mm) in the treatment of capillary vascular malformations. *Plast Reconstr Surg* 1993;92:1233.
19 Havas DR, Noodleman R. Using a low current radiosurgical unit to obliterate telangiectasias. *J Dermatolog Surg Oncol* 1991;17:382-3.
20 Reid WH, McLeod PJ, Ritchie A, Ferguson-Pell M. Q-switched ruby laser treatment of black tattoos. *Brit J Plast Surg* 1983;36:4559.
21 Fitzpatrick RE, Goldmann MP, Dierckx C. Laser ablation of facial cosmetic tattoos. *Aest Plast Surg* 1994;18:91.
22 Glogan RG, Matarasso SL. Chemical peels, trichloroacetic acid and phenol. *Dermatol Clin* 1995;13:25.
23 Benedetto AV, Griffin TD, Benedetto EA, Humenink HM. Dermabrasion: therapy and prophylaxis of the photoaged face. *J Am Acad Dermatolog* 1992;27:439-47.
24 Kanvar ANB, Geronimu RG, Waldorf HA. Char-free tissue ablation: a comparative histopathologic analysis of new carbon dioxide (CO_2) laser systems. *Lasers Surg Med* 1995;16:50.
25 Grekin RC, Shelton RM, Geisse JK, Frieden I. 510 nm pigmented lesion dye laser: its characteristics and clinical uses. *J Dermatolog Surg Oncol* 1993;19:380-7.
26 Raus P, Mertens E. Evaluation of radiosurgery as a cosmetic surgery technique. *Int J Aest Restor Surg* 1997;2:96-100.
27 Pfenningen JL, Fowler GC. *Procedures for primary care physicians*. St Louis, MO: Mosby, 1994:91-101.
28 Grossmann MC. Laser targeted at hair follicles. *Lasers Surg Med* 1995;7:47.
29 Spiza M, Rosen T. Injectable soft tissue substitutes. *Clin Plast Surg* 1993;20:181-8.
30 Orgentas HE, Pindur A, Spiza M, Liu B, Shenag S. A comparison of soft tissue substitutes. *Ann Plast Surg* 1994;33:171-7.
31 Piacquadio D, Jarebo M, Goltz R. Evaluation of hylan b gel as a soft tissue augmentation implant material. *J Ann Acad Derm* 1997;36(4):544-9.
32 Male B. The use of Gore-Tex implants in aesthetic surgery of the face. *Plast Recon Surg* 1992;90:200-6.
33 Lemperle G, Haran-Gauthier N, Lemperle M. PMMA microspheres (Artecoll) for skin and soft tissue augmentation. Part II: clinical investigations. *Plast Reconstr Surg* 1995;96:627-34.
34 McClelland M, Egbert B, Hando V, Berg R, Delustro F. Evaluation of artecoll polymethyl-methylmethacrylate implant for soft tissue augmentation: biocompatibility and chemical characterization. *Plast Recon Surg* 1997;100:1466-74.
35 Guyuron B, Huddleston SW. Aesthetic indications for botulinum toxin injection. *Plast Reconstr Surg* 1994;93:913-8.
36 Uebel CO. The punctiform technique with 1000 micro- and minigrafts in one stage. *Am J Cosm Surg* 1994;11:293-303.
37 Uebel CO. Baldness surgery: the mega-punctiform technique. *Plast Surg Techniques* 1995;1(2):95-103.
38 Unger W, David L. Laser hair transplanting. *J Dermatol Surg Oncol* 1994;20:515.
39 Derma flesh perfector plus: medical grade adhesive for skin contact. *Material safety data sheet*. Dronten: HairTech Holland, 1998.

Lesson of the week

Tethered cord syndrome after myelomeningocoele repair

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Secondary tethering of the spinal cord after myelomeningocoele repair is a remediable complication that requires prompt treatment

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Although the incidence of neural tube defects has fallen appreciably in the past two decades, from 3.4/1000 live births and stillbirths in 1974 to 0.8/1000 in 1994, the decline seems to be levelling off.[1] The reduction is partly attributable to the increased consumption of folic acid by expectant mothers and partly to improved detection of defects in utero, which has led to the termination of approximately 50% of these pregnancies.[2] Current protocols for patient care and management mean that 85% of liveborn infants with neural tube defects are now expected to reach adulthood,[3] creating a cohort of people who are vulnerable to certain long term complications. Current healthcare systems need to be aware of this vulnerability, and adequate provision must be made if additional preventable disabilities are to be avoided in these people.

Although specific complications of renal failure, skin breakdown, and shunt malfunction have been highlighted in recent reports,[4] the importance of one particular complication—symptomatic secondary tethering of the spinal cord—may have been underemphasised. We report one such case in an adolescent girl who presented with acute deterioration of her neurological status 17 years after surgical closure of her myelomeningocoele.

Case report

A 17 year old girl presented with a constant dull backache and weakness in her legs that made her unable to bear weight. A lower lumbar myelomeningocoele had been repaired by a paediatric surgeon within 24 hours of her birth. She had not required any treatment for hydrocephalus. At 20 months of age the girl was walking despite distal sensorimotor deficits in her left leg. Urinary incontinence was managed by intermittent catheterisation. She remained under orthopaedic care, and had undergone several procedures to correct foot deformities.

The girl led an independent existence with the aid of a wheelchair. She lived at home with her mother and two younger siblings, attended a normal school, had a part time job at a nursery, and aspired to become a nursery teacher. She could walk unassisted for about half a mile and continued to manage her urinary symptoms by intermittent self catheterisation. However, she retained some capacity for voluntary micturition.

During the six months leading up to her neurological decline the patient had three separate episodes in which she lost the ability to void urine spontaneously. Findings at urological investigations were normal, and each episode resolved spontaneously. Four weeks before presentation she noticed an abrupt overnight reduction in the strength of her legs. The girl experienced an insidious decline thereafter, losing most function in the left leg and some in the right. This came to light during a routine orthopaedic follow up and she was referred to a paediatric neurosurgeon.