An analysis of seventy-two cases of ununited fracture occurring in the long bones of children / by D'Arcy Power.

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OF

UNUNITED FRACTURE OCCURRING IN THE LONG BONES OF CHILDREN.

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SURGEON IN CHARGE OF OUT-PATIENTS AT THE VICTORIA HOSPITAL FOR CHILDREN, CHELSEA; DEMONSTRATOR OF SURGERY AT ST. BARTHOLOMEW'S HOSPITAL.

Read December 8th, 1891.

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Received June 30th—Read December 8th, 1891.

The subject of ununited fractures in long bones is one which has always been of great interest to the surgeon, though he has never been able to give a satisfactory explanation of the cause. During the present century three well-known series of tables of ununited fractures have been compiled. The earliest is by Dr. George W. Norris, a surgeon to the Pennsylvania Hospital, who in 1842 published 150 cases of non-union after fractures.[1] The second series was collected by Dr. Gurlt, and is published in his 'Handbuch der Lehre von den Knochenbrüchen,' Berlin, 1862. It consists of 484 cases drawn from all sources. The third and most extensive series was issued by the late Prof. Agnew, who, in his great work

[1] 'The American Journal of the Medical Sciences,' N. S., vol. iii, p. 1.

on the 'Principles and Practice of Surgery,' Philadelphia, 1878, has collected, by the energy of Dr. Frank Muhlenberg, no less than 685 cases of ununited fractures of the shafts of long bones. In this large number, however, are included many of Norris's and Gurlt's cases. We have thus in an accessible form 1319 cases of ununited fracture duly tabulated, and including persons of all ages.

No one hitherto has been at the trouble to collect and to publish cases of ununited fracture in children, although it is known that they often possess features of especial interest. As my attention has recently been called to the fact of their occurrence, and circumstances have led me to collate the literature of the subject, I have thought that it might prove useful if I tabulated the cases which I have met with. I have accordingly done so, and it is with a consideration of this table that I propose to occupy a short period of your time this evening.

Sir James Paget, in the very interesting series of essays entitled 'Studies of Old Case-books,' which has been recently issued, says, "I have seen only three cases of ununited fractures in young children, and the measures which are usually sufficient for the cure of this defect in adults were in all these cases completely useless. Similar cases have occurred to others; and, so far as I know, they have not been explained" (p. 130). The table of cases which I present to you shows that Sir James Paget's opinion holds true even when his conclusion is applied to a very large series of cases. How little attention has been bestowed upon the subject of ununited fractures in children is manifest from the fact that it has escaped the notice of so careful and experienced an observer as our President, Mr. Timothy Holmes.

There is no doubt whatever about the rarity of cases of ununited fracture in young children, though I am rather inclined to think that they are becoming somewhat more numerous than was formerly the case. Dr. Norris, in his table of 150 cases, only records a single instance of non-union in a child which had come under his personal

notice (No. 23). Gurlt in 484 cases gives 14 in children, whilst Agnew in his 685 cases records 28 instances of non-union in children under ten years of age. I find, however, that Prof. Agnew's tables make three separate cases out of one which was recorded by Tamplin, so that the cases which he tabulates as Nos. 641, 642, and 643 are the same patient at different periods; and the same error has crept in with regard to Nos. 65 and 220, so that this reduces the number to a total of 25.

From the annexed table it will be seen that I have been able to obtain details of 72 cases of ununited fracture in the long bones of children under ten years of age. From a consideration of the tables it is obvious that the fractures group themselves into three classes. The first, in which the fracture is intra-uterine, or at any rate in which it was noticed directly after birth; the second class embraces those fractures which occur in young children, often as a result of slight violence, and it is to this class that I wish to direct special attention this evening. Finally, there is a third class which embraces the bulk of the cases in which the fracture took place in older children, either as the result of an accident in the usual manner, or the non-union followed upon an osteotomy or other operation performed for the relief of deformity. As an extremely rare condition spontaneous fracture is met with in children, just as it is occasionally seen in adults. In my table I have endeavoured to exclude cases of non-union following compound fracture, as in such cases the pathology of repair is so different.

Of the cases I have collected it will be seen that 6 occurred in the clavicle, 7 in the humerus, 12 in the femur, and 45 in the leg, where the fracture involved one or both bones. It is interesting to notice that I have met with no recorded case of ununited fracture of the lower jaw, nor as yet of the bones of the forearm,[1] and this is

[1] Since this paper was written Mr. Anderson has had a case of ununited fracture of the radius in a boy under his care at St. Thomas's Hospital. He tells me that after operation he has obtained bony union, and he has kindly

still more interesting when we consider the statistics of fractures as they are met with in children. I have amalgamated the figures given by Marjolin, Langenbeck, Packard, and Beck, which amount in the aggregate to 1070 cases. Of these there were—

Fractures of the	forearm	. . .	328
,,	,, humerus	. . .	228
,,	,, clavicle	. . .	227
,,	,, femur	. . .	213
,,	,, leg	. . . .	74

—thus showing that although fractures of the forearm are so much more frequent than those of any other bone, they most rarely result in non-union (a very unexpected result at which to arrive), whilst after fractures of the leg the proportion of cases of non-union is appallingly great.

As regards the sex of the patients pseudarthrosis occurred in 40 males and in 29 females, whilst in 3 cases the sex is not mentioned. It seems to be a pretty generally entertained opinion that non-union is more frequently seen on the left than upon the right side. I am sorry that my tables do not settle this point, owing to the fact that so few observers have noted the side upon which the fracture occurred. In 47 cases where the side is mentioned I find that in 24 cases it was upon the right, and in 22 cases it was upon the left, whilst in 1 case both bones of both legs were fractured. Of the total number of 72 cases of false joint bony union resulted in 21 cases owing to the treatment which was adopted ; in 4 cases the patient was improved, or in other words the fibrous union was rendered somewhat firmer, thereby enabling the patient to get about in some form of apparatus ; but in 45 cases, or nearly two thirds of the total number, the condition of the patient's limb remained the same, and I there-

allowed me to include the case in my table No. 14. I have also found a case of ununited fracture of the radius and ulna recorded by Dr. Norris, but it seems to have been an instance of delayed union rather than one of pseudarthrosis.

fore class these cases as failures. Of the cases which were cured, nine appear to have been examples of delayed union rather than of ununited fractures, as union took place at intervals varying from three to eighteen months after the injury.

It would appear from a study of the table that ununited fractures in children are becoming somewhat more frequent in this country than they used to be. This can no doubt in part be accounted for by the greater care with which such fractures are recorded; partly by the fact that increased facilities for locomotion now allow of such cases being gathered into one or other of the numerous Hospitals for Children which are established in most large towns. Forty years ago such patients would have remained in country districts, where they would only occasionally have come under the notice of practitioners too busy to give them more than a passing thought, and who when they did think of them would only regard them as hopeless cases sooner or later destined for amputation. There is, however, another reason, I think, for the frequency of ununited fractures in children. In 1814 Roux, the great French surgeon, paid a visit to London, where he appears to have devoted his time to making a careful inspection of the hospitals. On his return to Paris he published his observations in an octavo volume of 368 pages, entitled 'Relation d'un voyage fait à Londres en 1814; ou parallèle de la Chirurgie angloise avec la Chirurgie françoise.' In this work, amongst other points, he remarks (page 192), "Il est probable qu'ils voient [*i. e.* English surgeons] très-souvent des consolidations tardives. Je soupçonne enfin que la pseudarthrose, c'est-à-dire la conversion d'une fracture en une fausse articulation, est un accident qu'ils ont plus souvent que nous l'occasion d'observer. C'est pour nous, chirurgiens françois, une chose si rare, de voir une fausse articulation succéder à une fracture, qu'il y a plusieurs années qu'on n'a pratiqué en France l'opération de White, c'est-à-dire, la résection des fragmens de l'os non consolidé, et que depuis

quelques années aussi qu'un chirurgien de Philadelphie, Physick, a conçu l'ingénieuse idée du traitement de la pseudarthrose par l'interposition et le séjour momentané d'un séton entre les bouts de l'os non consolidé, pour y exciter l'inflammation adhésive, cette opération n'a été pratiquée, que je sache du moins, par aucun chirurgien françois." This increased frequency of the non-union in England Roux attributed to the fact that the roller bandage used here is much more difficult to keep firmly applied than the many-tailed bandages which are commonly used in France. Whatever may be the real cause of this remarkable rarity of non-union in France, there is no doubt that it was maintained for many years. In a lecture given in 1860 at the Hôpital des Enfants[1] in Paris, M. Guersant says, "I have only seen a single case of ununited fracture occurring in a child in the whole of my long experience, and for this child everything was done, but ineffectually, and her leg had to be amputated (No. 69). M. Marjolin, in his edition of 'Coulon's Treatise on Fractures in Children,' states that up to the time he was writing he had never met with a case.

It appears to me that want of rest is the main cause of the non-union of fractures, though there may be many subordinate factors. Hamilton, in his paper published in the 'Buffalo Medical Journal'[2] so long ago as 1854, pointed out that hinge-movements between the ends of a fractured bone are the most fertile source of non-union. It is exactly this kind of movement which occurs in the broken bones of children when they are nursed or carried about, especially when, as frequently happens, the fracture has been overlooked, and no restraining apparatus has been employed for a week or ten days after the injury. This explanation, however, will not account for the increasing frequency of false joints in children; but I am inclined to correlate this phenomenon with the decadence of bandaging in England. With a roller bandage well

[1] 'Gaz. des Hôpitaux,' 1860, p. 346.

[2] See 'A Practical Treatise of Fractures and Dislocations,' ed. 7, p. 287.

applied, and a wooden splint, it is quite possible to render all fractures of long bones absolutely immovable, without exercising any injurious pressure. Of late years, however, we are, I think, inclined to trust somewhat too much in cases of fracture, and especially in the fractures of children, to plaster-of-Paris splints and cases, which, being left to others to apply, are not quite accurately moulded to the limb. The increased frequency of non-union is, perhaps, also partly to be explained by the comparative contempt with which we are in the habit of regarding fractures since osteotomy has made us more familiar with their pathology and treatment. This, again, may lead us to be a little careless in insisting from the beginning upon the maintenance of that absolute immobility of the fragments which is so necessary for repair. Then, when fibrous union results, we find to our cost that there is little or no tendency to produce bone, even when we use every means in our power to evoke a deposition of callus. I am utterly unable to explain the pathological process upon which this failure to produce bone really depends, but I cannot help thinking that it is due more to a local than to a constitutional cause, for the failure to unite often occurs in the bones of children who otherwise appear to be in perfect health.

Gentlemen, my purpose this evening has been fulfilled if I have directed your renewed attention to the subject of fractures in children, and if I have pointed out once more how important it is to secure by every means in our power immediate bony union, always bearing in mind that if this process fail our little patient will in all probability be a cripple for life.

In compiling the following table I have placed myself under great obligations to the surgeons of St. Bartholomew's Hospital, to Mr. Pick, Mr. Clutton, Mr. William Anderson, and Mr. Stephen Paget, to each and all of whom I hereby offer my best thanks for the kind permission they have so readily accorded me to make use of their cases.

Table of Cases.

No.	Sex.	Age of patient.	Bone.	Position.	Side.	Duration.	Treatment.	Result.	Surgeon.	Where recorded.
1	F.	15 mos.	Clavicle	Junction of outer with middle third	Right	4 mos.	Resected and wired	Bony union	Pollard	'Brit. Med. Journ.,' vol. i, 1887, p. 676.
2	F.	22 mos.	,,	,,	Left	8 mos.	Rubbing, firm bandage	Fibrous union	Power	Unpublished.
3	F.	2 years	,,	Not stated	Right	3½ mos.	Plaster-of-Paris bandage	,,	Nairn	Victoria Hospital for Children, 1891. Cf. No. 7.
4	M.	8 years	,,	Middle third	Not stated	Not stated	Not stated	,,	Holmes Coote	'Trans. Med.-Chir. Soc.,' vol. li, p. 146.
5	F.	9 years	,,	,,	Right	Unknown	None	,,	Edgar Willett	Unpublished.
6	M.	12 years	,,	Not stated	,,	Almost since birth	Resection, wired	Bony union	Barker	'Trans. Clin. Soc.,' vol. xix, p. 104.
7	F.	2 years	Humerus	Middle	Left	3½ mos.	Plaster-of-Paris bandage	Fibrous union	Nairn	Victoria Hospital for Children, 1891. Cf. No. 3.
8	M.	5 years	,,	,,	Not stated	12 mos.	Ends resected	Bony union	Brinton	Agnew,[1] No. 172.
9	M.	6 years	,,	Not stated	Left	3 mos.	Tinct. Iodi locally; lime internally for a very rickety child	,,	Paul	'Conservative Chirurgie,' p. 291; Agnew,[1] No. 42.
10	F.	6 years	,,	Lower third	Right	18 mos.	Ends resected and pinned	,,	Langenbeck	'Deutsche Klinik,' 1854, vol. vi, p. 264; Agnew,[1] Nos. 65 and 220.
11	M.	9 years	,,	Junction of middle with lower third	Not stated	27 weeks	Resection; ends drilled and wired	Not stated	Russell	'Lond. Association Med. Journ.,' June, 1854; Agnew,[1] No. 182.
12	M.	9 years	,,	Middle	,,	6 mos.	Ends resected	Bony union	White	'Philosophical Trans.,' vol. li, part 2, p. 657; 'Cases of Surgery, with Remarks,' Lond., 1770, part 1. p. 69.

13	M.	10 years	„	Not stated	Right	Not stated	Not stated	Fibrous union	Savory	pital, 1869.
14	M.	7 years	Radius	Lower third	Left	38 days	Resected and wired	Bony union	W. Anderson	St. Thomas's Hospital, 1892.
15	M.	12 years	Radius and ulna	Near the middle of the forearm	Not stated	4 weeks	Fixed securely	„	Norris	'Amer. Journ. Med. Sci.' (1839), vol. xxv, p. 273.
16	M.	15 mos.	Femur	Junction of lower with middle third	Left	2½ mos.	Fixed securely	Fibrous union	v. Bruns	Gurlt,[2] No. 132.
17	F.	15 mos.	„	„	„	3 mos.	„	„	Pick	Victoria Hospital for Children, 1891.
18	F.	16 mos.	„	Not stated	„	8 mos.	„	Improvement	Clutton	Victoria Hospital for Children, 1888.
19	M.	18 mos.	„	Junction of middle with lower third	„	11 weeks	Interposed mass forcibly broken up	Fibrous union	v. Bruns	'Deutsche Klinik,' 1861, vol. xiii, p. 172, case 19; Agnew,[1] No. 458.
20	F.	19 mos.	„	Junction of upper with middle third	Right	Congenital	Securely fixed	„	Langton	St. Bartholomew's Hospital, 1890.
21	—	2½ years	„	Not stated	Not stated	5 weeks	Gutta-percha thigh-piece and outside splint for 59 days	Bony union	Not stated	'St. Thomas's Hospital Reports for Patients for 1864,' p. 135.
22	M.	3½ years	„	Multiple spontaneous fractures	Left	6 mos.	Securely fixed	Fibrous union	Pick	Victoria Hospital for Children, 1889.
23	M.	4 years	„	Middle	Right	Congenital	Wired	Bony union	Wutzer	Gurlt,[2] No. 455.
24	—	11 years	„	„	„	4 years	Not stated	Fibrous union	Taylor	St. Bartholomew's Hospital Museum, No. 854.
25	M.	12 years	„	Junction of upper with middle third	„	7 mos.	Ends refreshed	„	Morrant Baker	St. Bartholomew's Hospital, 1890.
26	M.	Not stated	„	Middle	„	11 mos.	Seton: good diet	Bony union	Lyford	'Lond. Med. and Surg. Journ.,' vol. iii (1829), p. 78.
27	M.	„	„	Not stated	Not stated	Not stated	„	„	Brodie	'Lectures on Pathol. and Surgery,' p. 132.

[1] 'The Principles and Practice of Surgery,' by D. Hayes Agnew, M.D., LL.D., Philadelphia, 1878, pp. 752—793.

[2] 'Handbuch der Lehre von den Knochenbrüchen,' by Prof. Gurlt, Berlin, 1862, Th. i, pp. 686—723.

No.	Sex.	Age of patient.	Bone.	Position.	Side.	Duration.	Treatment.	Result.	Surgeon.	Where recorded.
28	F.	18 mos.	Tibia and fibula	Lower third	Left	Congenital	Securely fixed	Fibrous union	Stephen Paget	Unpublished.
29	M.	4 years	,,	,,	Not stated	,,	Not stated	,,	Curling	'Med. Times and Gaz.,' N.S., xi (1855), pp. 189, 544.
30	M.	4 years	,,	Middle	,,	,,	Resected and wired	Bony union	Wutzer	Gurlt,[2] No. 455.
31	F.	7 years	,,	Lower third	,,	,,	Resection	Fibrous union	Henry Smith	'Trans. Pathol. Soc.,' vol. xviii, p. 215.
32	F.	11 years	,,	Two inches above the ankle	,,	,,	Blister, resection, acupuncture	,,	Mott	'Trans. New York Acad. of Med.,' vol. i (1857), p. 82, case 9.
33	F.	11 years	Tibia	Upper third	Right	,,	Resection	,,	Morrant Baker	St. Bartholomew's Hospital, 1886.
34	M.	21 years	Tibia and fibula	Junction of middle with lower third	,,	,,	Wiring, amputation	,,	Langton	St. Bartholomew's Hospital Museum, No. 858.
35	—	Infant	,,	Lower third	,,	,, ?	Not stated	,,	Not stated	St. Thomas's Hospital Museum, No. 267[a].
36	F.	13 mos.	,,	1½ inches above ankle	Not stated	6 weeks	,,	Not stated	Packard	Keating, vol. iii, p. 1095.[3]
37	F.	14 mos.	,,	Middle, after osteotomy for badly united congenital fracture	Left	6 mos.	Bone grafted	Death from scarlet fever	Clutton	Victoria Hospital for Children, 1888.
38	F.	2 years	,,	1¾ inches above ankle	Right	13 mos.	Drilled, wired	Fibrous union 8 years later	Callender	St. Bartholomew's Hospital, 1879 and 1887.
39	M.	Just beginning to run	,,	Middle	Not stated	Treated at once	Fixed, scraped, wired	Amputation 10 years later	Sir Jas. Paget	'Studies of Old Case-books,' p. 133.
40	F.	2½ years	,,	Junction of middle with lower third	Left	18 mos.	Wired	Amputation	Lockwood	St. Bartholomew's Hospital Museum, No. 858[a].

[illegible]	[illegible]	[illegible]	[illegible]	middle	[illegible]	birth	resection	union		Chir. Soc.,' ser. 3, vol. iv, p. 39.
42	F.	3½ years	,,	Junction of middle with lower third	Left	31 mos.	Securely fixed, seton, pegged	Amputation at 15 years	Sir Jas. Paget	'Studies of Old Case-books,' p. 130.
43	M.	4 years	Tibia	Middle	Not stated	15 mos.	Resection	Fibrous union	Tapp	'Med. Times and Gaz.,' 1856, vol. ii, p. 347, No. 2.
44	F.	4 years	Tibia and fibula	Not stated	Left	2 years	,,	Improvement	Dupuytren	Agnew,[1] No. 498; Gurlt,[2] No. 416.
45	M.	4 years	,,	Lower third	Right	30 mos.	Resected and wired	Amputation	W. Adams	Hunterian Museum, Roy. Coll. Surg., No. 813[a].
46	M.	4 years	Tibia	Not stated	Not stated	12 mos.	Resection	Bony union	W. G. Williams	'Western Med. and Surg. Journ.,' Jan., 1852; Agnew,[1] No. 597.
47	F.	4 5/12 years	Tibia and fibula	Middle	,,	5 mos.	Resected and wired	,,	Ashby & Wright	'Diseases of Children,' p. 497.
48	M.	5 years	Tibia	Not stated	Right	12 mos.	Ends scraped, seton, pressure	Fibrous union	Brodie	'Lectures on Pathology and Surgery,' p. 132; 'Lancet,' 1834-5, pp. 262, 532.
49	M.	Not stated	Tibia and fibula	,,	Not stated	Not stated	Securely fixed	,,	Jameson	Unpublished.
50	F.	5 years	Tibia	Junction of middle with lower third	Left	2 years	Pegged, resected, wired	Bony union	Fifield	'Med. News,' Philadelphia, vol. xlii (1883), p. 414.
51	M.	5 years	Tibia and fibula	Middle	Right	2 years	Not stated	Fibrous union	Brodie	'Lond. Med. and Surg. Journ.,' vol. vi (1835), p. 667, and vol. vii, p. 443.
52	M.	5½ years	,,	A little below the middle	,,	4 years	Rubbed, wired, pegged, fixed	,,	Sir Geo. Humphry	Cambridge University Pathological Museum, No. 1324.
53	M.	6 years	,,	Junction of middle with lower third	,,	4 years	Bone grafting from rabbit, twice	Amputation	Southam	'Brit. Med. Journ.,' vol. i (1891), p. 1179.
54	M.	6 years	Tibia	Not stated	Not stated	3 years	Acupuncture	Improvement	Bell	Roux,[4] p. 195; Agnew,[1] No. 584; Gurlt,[2] No. 267.

[3] 'Cyclopædia of the Diseases of Children,' by J. M. Keating, M.D., Edinburgh and London, 1890.

[4] 'Relation d'un voyage fait à Londres en 1814,' par Philibert Joseph-Roux, Paris, 1815.

No.	Sex.	Age of patient.	Bone.	Position.	Side.	Duration.	Treatment.	Result.	Surgeon.	Where recorded.
55	M.	6 years	Tibia and fibula	Not stated	Left	58 mos.	Twice resected	Bony union	Davies Colley	Guy's Hospital Museum, 1260_{36}.
56	M.	$6\frac{7}{12}$ years	,,	Lowest fourth	,,	$5\frac{1}{4}$ years	Splints and plaster of Paris	Fibrous union	Edmund Owen	'Proc. Royal Med. and Chir. Soc.,' ser. 3, vol. iv, p. 38.
57	M.	8 years	,,	Middle	Not stated	4 or 5 years	Pegged	Amputation 2 years later	Holmes Coote	The 'Lancet,' vol. i (1862), p. 664.
58	F.	8 years	,,	,,	Right	5 years	Resected and wired	Amputation	Sir Jas. Paget	'Studies of Old Case-books,' p. 135.
59	M.	8 years	Tibia	3 inches above ankle	Left	12 mos.	Resection	Fibrous union	Churchill	Victoria Hospital for Children, 1886.
60	F.	9 years	,,	Not stated	Right	Several months	Tenotomy, drilling	Bony union	Dieffenbach	Casper, 'Woch. f. Heilkunde,' 1846, p. 730.
61	M.	10 years	Tibia and fibula	,,	Not stated	3 years	Resection	,,	Stocks	Agnew,[1] No. 493; 'Massachusetts Med. and Surg. Reporter,' 1870.
62	M.	10 years	Tibia	,,	,,	3 years	Not stated	Improvement	Ward	'Medical Times,' vol. xxii (1850), p. 593.
63	F.	10 years	,,	Lower third	,,	8 years	,,	Amputated	Cæsar Hawkins	'Trans. Pathol. Soc.,' vol. ii, p. 253.
64	F.	10 years	Tibia and fibula	,,	Left	8 years	Leather splints	Amputation	Not stated	St. George's Hospital Museum, series i, No. 203; cf. p. 132.
65	M.	13 years	,,	,,	Right	$12\frac{3}{4}$ years	Resected and pegged	Fibrous union	Bowman	The 'Lancet,' vol. ii (1852), p. 153; Agnew,[1] No. 562.
66	M.	14 years	,,	,,	Left	6 years	Resected and pinned	,,	Morrant Baker	St. Bartholomew's Hospital, 1889.
67	M.	Not stated (boy)	,,	,,	Not stated	18 mos.	Ends bored and scraped	Tibia, bony union; fibula,	Wood	'American Med. Times' (New York), 1861, vol. ii, p. 13.

		stated (boy)						union	rence	(1857), p. 198.
69	F.	Not stated (girl)	Tibia and fibula	Not stated	Not stated	Not stated	Fixation, cautery, seton, rubbing	,,	Guersant	'Gazette des Hôpitaux,' 1860, p. 346; Coulon, 'Traité clin. et prat. des fractures chez les enfants,' p. 49.
70	F.	20 years	Tibiæ and fibulæ	,,	Right and left	Since childhood	Not stated	,,	Marshall	'Trans. Path. Soc.,' vol. xviii, p. 240.
71	M.	23 years	Tibia and fibula	Lower epiphysial line	Left	19 years	Wired 11 months before death	,,	Sir Geo. Humphry	Cambridge University Pathological Museum, No. 1325.
72	F.	25 years	Tibia	Lower third	Not stated	$23\frac{10}{12}$ years	Firm fixation	Bony union	Tamplin	'Lond. Med. Gaz.,' vol. xlvi (1850), p. 140; Agnew,[1] Nos. 641, 642, and 643.

Appendix.

By the kindness of the authorities of St. George's Hospital in general, and of Dr. H. D. Rolleston in particular, I am able to show a dissected specimen (No. 64 in the table of cases) of an ununited fracture in the left leg of a child. The tibia is broken about four inches and the fibula about two inches above the ankle. The lower fragments of both bones are tilted forward, overlapping the opposite fractured extremities. The upper ends of the lower fragments are rounded off, and are covered with a dense fibrous structure. The lower ends of the upper fragments are connected with the contiguous fragments throughout nearly the whole of the circumference by a dense fibrous capsule or band holding them firmly together. A part of each upper fragment, however, is not covered with any such deposit, but is movable upon a similar uncovered part of the lower fragment. The tibialis anticus and the extensor proprius hallucis are pushed outwards by the projecting part of the tibia, and the extensor longus digitorum is displaced by the fibula, which is embedded more or less in its muscular fibres. The peroneus longus and brevis are also thrown forwards and outwards as they pass behind the external malleolus.

The fracture is said to have been of eight years' standing in a girl of ten years old. The bones were movable at the seat of fracture, and the skin was ulcerated at the same point, owing apparently to the projection of the fragments. The leg was wasted, and was three inches shorter than its fellow.

When the child was two years old she was struck with a cricket ball, which bruised but did not appear to break her leg. She was put to bed and poulticed, and after a time leather splints were applied. She was at this time in bad health, and her leg became "bowed out." Ten months later it broke, and since that time it has twice

been broken. Two years before her admission to the hospital she was an in-patient for six weeks, when splints were applied, but without good result. The limb was amputated, and the patient made an excellent recovery.[1]

[1] St. George's Hospital Museum, Series I, No. 203.

(For report of the discussion on this paper, see 'Proceedings of the Royal Medical and Chirurgical Society,' Third Series, vol. iv, p. 35.)