SAS Journal of Medicine
Abbreviated Key Title: SAS J Med
ISSN 2454-5112
Journal homepage: https://saspublishers.com

OPEN ACCESS

Radiology

Bertolotti's Syndrome: An Underdiagnosed Cause for Lower Back Pain in Young Adults

Soufiane Belabbes[1, 2*], M. J. Doumbeneny[3], Christelle Chavihot[1], B. E. Nguema[1]

[1]Radiology Department, HIAOBO, Libreville, Gabon
[2]Radiology Department, Faculty of Medicine and Pharmacy, Sidi Mohammed ben Abdellah, Fes, Morocco
[3]Epidemiology Department, HIAOBO, Libreville, Gabon

DOI: 10.36347/sasjm.2022.v08i04.022 | **Received:** 18.03.2022 | **Accepted:** 21.04.2022 | **Published:** 25.04.2022

***Corresponding author:** Soufiane Belabbes
Radiology Department, HIAOBO, Libreville, Gabon

Abstract **Original Research Article**

Bertolotti's syndrome (BS) is characterized by a fifth lumbar (L5) vertebra anatomic variation with a large transverse process that forms a pseudoarthrosis or a bony fusion with the sacral basis or iliac crest. This congenital variation can cause low back pain especially in young patients, but it is always a factor that is not addressed in the evaluation and treatment of lower back pain. The purpose of this study was to assess the etiology of low back pain and to determinate the incrimination of BS in chronic low back pain.

Keywords: Bertolotti syndrome; Lumbosacral transitional vertebra (LSTV); low back pain; lumbosacral arthritis; Ct-scan.

INTRODUCTION

Bertolotti's syndrome, first described in 1917 by Mario Bertolotti, is a clinic-radiographic entity with a pseudoarticulation between unilateral or bilateral enlarged transverse process of the fifth lumbar vertebra and the ala of the sacrum or the iliac crest [1]. These changes are associated with low back pain secondary to arthritic changes. This entity connection is known as a lumbosacral transitional vertebra (LSTV) [2].

LSTVs are seen in approximately 10% of spine radiographs [3]. Meanwhile, Bertolotti's syndrome is said to affect 4% to 8% of adults with low back pain [4], but is often overlooked when evaluating patients for low back pain.

Since then, the nature of the link between lumbosacral transitional vertebrae, low back pain and disc degeneration has been the subject of much debate. It has been claimed that the disc above the transitional vertebra is subject to increased stress which renders the vertebral motion segment hypermobile and prone to early degeneration. also, the asymmetry of movement between the transitional vertebrae and the sacrum may accelerate these changes [5].

We have reviewed a series of consecutive elective Ct- scans of the lumbosacral spine performed over a period of 24 months to quantify the incidence of Bertolotti's syndrome in the population at large, and especially among young patients. Then we analyzed the various associated pathologies of the lumbar spine.

MATERIALS AND METHODS

A retrospective descriptive study over a period of 24 months (from April 1, 2020 to March 31, 2022) carried out in the radiology and medical imaging department of the Military teaching hospital Omar Bongo Ondimba (HIAOBO), Libreville.

Data collection was based on simple random sampling. 960 patients of both sexes were recruited for lumbar Ct- scans, including 890 patients with common low back pain and 70 patients with symptomatic low back pain.

They are included in our study, all patients with common low back pain. Our study did not include other cases with symptomatic low back pain (especially, infectious causes, tumors, and traumatic origins).

The clinical files were used to collect information about patients, their clinical and

radiological symptoms. All patients included in our study were scanned in a Siemens Somaton (64 slices), with a volumetric acquisition enabling a sagittal, coronal reconstruction and three-dimensional reconstruction.

Statistical analysis: Data entry and processing was performed using Microsoft Word 2010 software. Data was analyzed using Stata software version 14. Statistical significance was set at p ≤0.05. 95% confidence interval: 38.04-49:31

The records and data collected in our study were kept confidential.

RESULTS

A total of 890 consecutive patients suffering from common low back pain underwent elective Ct-scan of the lumbosacral spine. There were 480 males (53.9%) and 410 females (46.1%) with a mean age of 40 ±2 years. The male dominated the study with a sex ratio calculated at 1.17.

The Ct-scan findings showed multilevel disc degeneration in 539 patients (60.6%) with the mean age of 60 ± 5years, single-level disc degeneration in 235 (26.4%) with the mean age of 42 ±4years, a normal scan in 91 patients (10.2%) and Bertolotti's syndrome in 25 (2.8%). The levels involved in the single-level group are summarised in Table I.

Table I: Levels involved in patients with single-level disc degeneration:

Level	Effective	Percentage
L1/L2	1	0.4
L2/L3	4	1.7
L3/L4	5	2.1
L4/L5	145	61.7
L5/S1	80	34.1
Total	235	100

In our study, the incidence of Bertolotti's syndrome in the whole series was 2.8%. However, when the normal scans were removed from the total group, the incidence rose to 3.3%. There were more men (68%) than women (32%) with sex ratio calculated at 2.12, and a mean age of 43.68 ±13 years. The age group from 25 to 44 years old is the most represented at 56% (Figure 1). This age group represents the young adult according to the world health organization [6].

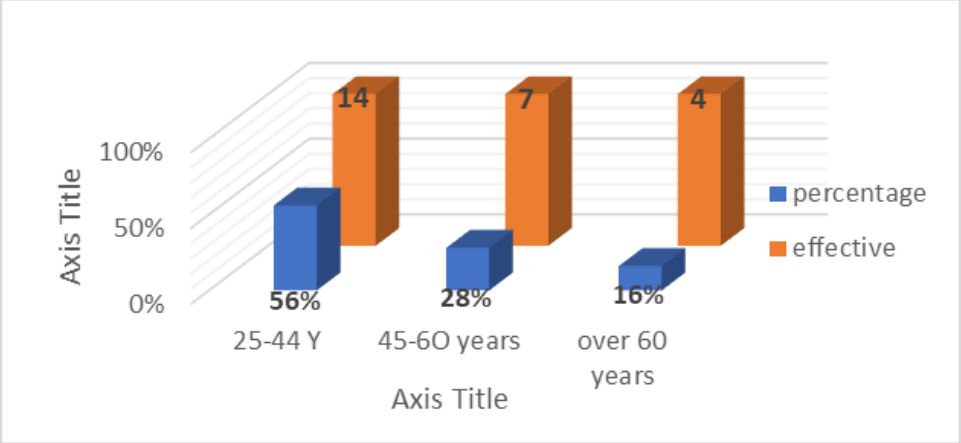

Fig-1: Number and percentage of Patients with BS by Age Range

According to the classification of Castellvi, Goldstein and Chan [7] (Figure 2), 19 had type-2 lumbosacral transitional vertebrae, seventeen type-2a and 2 type-2b. Three patients had type-3, Two had type-3a and 1 type-3b. and three patients had type-1a.

Lumbosacral transitional vertebrae type-2a was the more common variation in males in the age group from 25 to 44 years without significant difference (Table II and III).

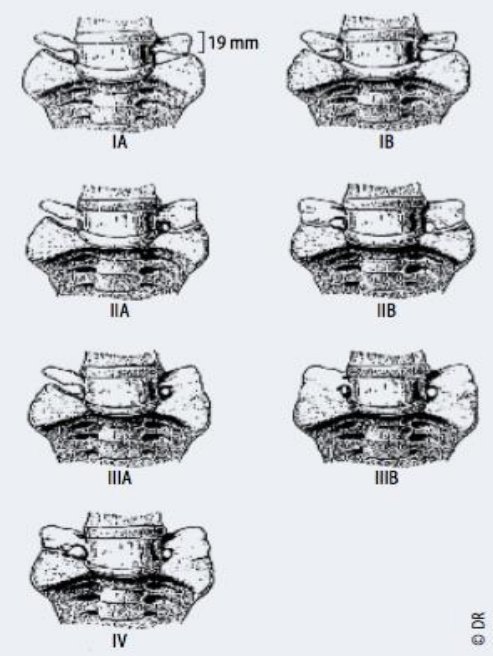

Fig-2: Castellvi radiologic classification

Table II: Distribution of Bertolotti's syndrome types according to gender (n=25)

Types	**Effective (%)**		**Total**	***P value***
	Féminin	**Masculin**		
Ia	1(12,50%)	02 (11,76%)	03	0,221
IIa	**05** (62,50%)	12 (70,59%)	17	
IIb	02 (25%)	00 (0%)	02	
IIIa	00 (0%)	02 (11,76%)	02	
IIIb	00(0%)	01 (5,89%)	01	
Total	08 (100%)	17 (100%)	25	

Table III: Distribution of Bertolotti's Syndrome according to age group (n=25)

Types	**Effective (%)**			**Total**	***P value***
	25-44ans	**44-60ans**	**61ans et +**		
Ia	03(21,43%)	00(0%)	00 (0%)	03	0,719
IIa	08(57,14%)	05(71,43%)	04 (100%)	17	
IIb	01 (7,14%)	01(14,28%)	00(0%)	02	
IIIa	01 (7,14%)	01(14,28%)	00(0%)	02	
IIIb	01(7,14%)	00(0,0%)	00 (0%)	01	
Total	14 (100%)	07 (100%)	04 (100%)	25	

Of our 25 patients with BS, 22 had unilateral changes (Figure 3 & 4), sixteen with left side involvement and 6 with right side involvement. Only 3 had bilateral radiological involvement (Figure 5). Type-2a on the left side was the most dominant at 81.25% with a statistically significant difference (Table IV).

Table IV: Distribution of the affected side within the different types of Bertolotti's syndrome in our patients (n=25)

Types	**Effective (%)**			**Total**	***P value***
	Bilatéral	**Droit unilatéral**	**Gauche unilatéral**		
Ia	00(0%)	00(0%)	03(18,75%)	03	0,001
IIa	00(0%)	04(66,67%)	13(81,25)	**17**	
IIb	02(66,67%)	00(0%)	00(0%)	02	
IIIa	00 (0%)	02(33,33%)	00(0%)	02	
IIIb	01 (33,33%)	00(0%)	00(0%)	01	
Total	03	06	16	25	

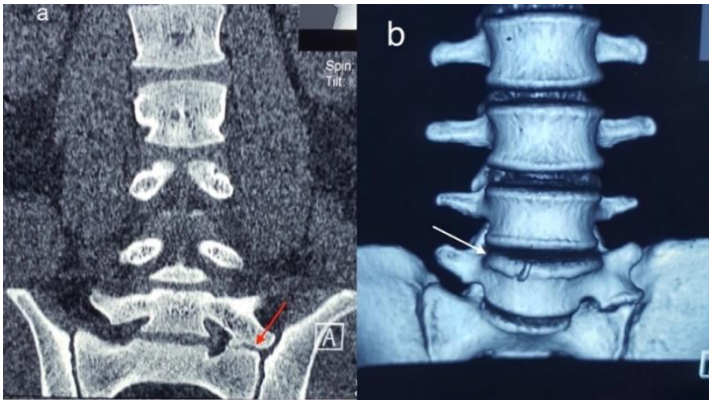

Fig-3: a, Coronal reformatted CT image showing a type-2a BS with pseudoarthrosis (red arrow) between the left transverse process of L5 vertebra and sacral ala with marginal spurring and bone sclerosis. b, volume rendered CT image showing the pseudoarthrosis between the left transverse process of L5 vertebra and sacral ala, and L4/5 degeneration (white arrow)

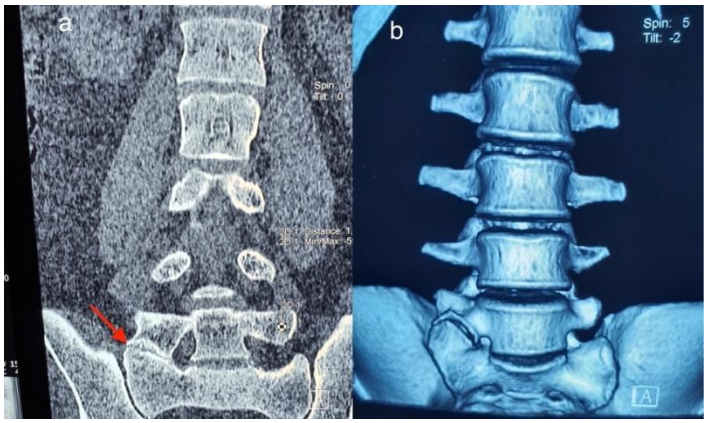

Fig-4: a, Coronal reformatted CT image showing a type-2a Bertolotti's syndrome with pseudoarthrosis (arrow) between the right transverse process of L5 vertebra and sacral ala with marginal spurring and bone sclerosis. b, volume rendered CT image showing the pseudoarthrosis

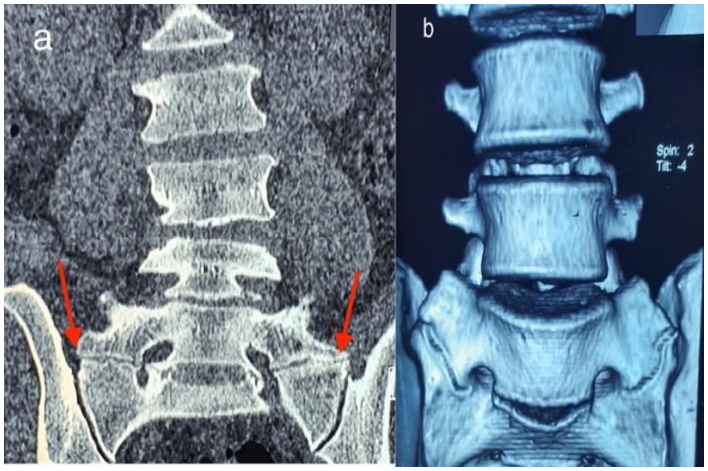

Fig-5: a, Coronal reformatted CT image showing a type-2b BS with pseudoarthrosis (arrow) between both transverse process of L5 vertebra and sacral ala. b, volume rendered CT image showing the bilateral pseudoarthrosis

Ten of our patients in the Bertolotti's group had disc degeneration at L4/5 which is the level above the transitional level. Their mean age was 35 years, no other isolated level disc degeneration was observed. Meanwhile The mean age of the single-level involvement in the whole group was 49 years. Similarly, the mean age of patients with multilevel disc degeneration in the Bertolotti's group was 52 years, meanwhile the mean age in the whole group with multilevel involvement was 60years. Isthmic lysis was also noted in the level above the transitional vertebra in two patients. The mean age of these patients was 40

years. All patients in the BS group with associated anomalies were younger than patients with the same anomalies in the group without transitional anomalies.

DISCUSSION

Bertolotti's syndrome is a form of lumbago in lumbosacral transitional vertebrae which represents an important cause of low back pain in young patients.

Since its designation in 1917, Bertolotti's syndrome has been the subject of much debate concerning its clinical significance and its biomechanical impact on the human spine. Nardo et al have reported on Castellvi classification [7] of LSTV that type-1 and type-3 are associated with a lower incidence of low back pain, whereas Type-2 and Type-4 are associated with higher incidence and severity of low back pain [8]. A second position is that LSTV does not increase the incidence of low back pain, but it does increase the severity of low back pain when present [9].

In our study, we attempted to quantify the overall incidence of Bertolotti's syndrome in the population with low back pain, and determine the age group most affected, at the difference with others series reporting asymptomatic radiological findings of transitional vertebrae [10]. Consequently, this incidence of Bertolotti's syndrome is more realistic than the incidence in the others series where the presence of a transitional lumbosacral vertebra is seen as incidental radiological findings in asymptomatic patients. The incidence of Bertolotti's syndrome in our study was 3.3% when the normal scans were removed from the total group. Quinlan et al studied 769 patients with low back pain and reported an incidence of BS estimated at 5.5% [11], which is a bit higher than the incidence in our series.

We also attempted in our study to determine the most frequent type of lumbosacral transitional vertebrae according to the classification of Castellvi, Goldstein and Chan [7], associated with low back pain in our population. Type-2a on the left side was the most dominant at 81.25% with a statistically significant difference, and was more frequent in the age group from 25 to 44 years, which represent the most active population. According to the literature, type-2 was the most frequent type of Bertolotti's syndrome in population with low back pain without precision of the side involved [10, 11].

The exact etiology of Bertolotti's syndrome remains unclear. However, two mechanisms have been implicated in the literature. A direct mechanism, with degenerative pain in the sacroiliac neo-joint as evidenced by scintigraphic fixation [12]. And an indirect mechanism, consisting of disc disease by overuse of the disc overlying intervertebral, consequence of the morphological asymmetry. An increased prevalence of disc protrusion or extrusion in the disc above the transitional L5 vertebra has been found in patients with LBP. A decreased prevalence of disc protrusion or extrusion was found in the disc below the transitional vertebra [13]. Secondly, there is a musculo-ligamentous repercussion with atrophy of the ipsilateral iliolumbar ligament, as evidenced by cadaver studies [14]. Finally, and incidentally, the degenerative consequences can sometimes lead to bone changes, a cause of neurological conflict [13]. In the present study, the most frequent associated anomaly was disc degeneration at L4/L5 which can be the origin of back pain.

The therapeutic management of Bertolotti's syndrome can be considered in 2 stages. The first step is medical treatment, consisting of NSAIDs combined with physical rehabilitation [15]. If the symptoms persist, CT-guided injections should be considered, with cortisone derivatives and/or anesthetics.

The second step corresponds to surgical treatment in case of resistance to medical treatment and certainty of link between morphological abnormality and clinical symptoms. Two techniques are mainly described in open surgery. The first consists of an excision of the transverse mega-apophysis. The second consists of vertebral or posterolateral arthrodesis between the transverse process and the sacrum. Overall, the results for the two techniques are similar, with, however, frequent persistence of distant pain [16].

CONCLUSION

In light of our findings and the social impact of low back pain in young people, Bertolotti's syndrome should be considered as a differential diagnosis when investigating young people with low back pain.

REFERENCES

1. Bertolotti M. Contributo alla conoscenza dei vizi differenzia- zione regionale del rachide con speciale riguardo all assimila- zione sacrale della V. lombare. Radiol Med 1917;4:113-44.
2. Jancuska, J. M., Spivak, J. M., & Bendo, J. A. (2015). A review of symptomatic lumbosacral transitional vertebrae: Bertolotti's syndrome. *International journal of spine surgery*, *9*, 42.
3. French, H. D., Somasundaram, A. J., Schaefer, N. R., & Laherty, R. W. (2014). Lumbosacral transitional vertebrae and its prevalence in the Australian population. *Global spine journal*, *4*(4), 229-232.
4. Singh, R., Telleria, M., & Patin, D. (2015). (195) Bertolotti's syndrome: a lesser known cause of chronic low back pain. *The Journal of Pain*, *16*(4), S24.
5. Aihara, T., Takahashi, K., Ogasawara, A., Itadera, E., Ono, Y., & Moriya, H. (2005). Intervertebral disc degeneration associated with lumbosacral transitional vertebrae: a clinical and anatomical

study. *The Journal of Bone and Joint Surgery. British volume*, *87*(5), 687-691.
6. Dyussenbayev, A. (2017). Age periods of human life. *Advances in Social Sciences Research Journal*, *4*(6).
7. Castellvi, A. E., Goldstein, L. A., & Chan, D. P. (1984). Lumbosacral transitional vertebrae and their relationship with lumbar extradural defects. *Spine*, *9*(5), 493-495.
8. Nardo, L., Alizai, H., Virayavanich, W., Liu, F., Hernandez, A., Lynch, J. A., ... & Link, T. M. (2012). Lumbosacral transitional vertebrae: association with low back pain. *Radiology*, *265*(2), 497-503.
9. Taskaynatan, M. A., Izci, Y., Ozgul, A., Hazneci, B., Dursun, H., & Kalyon, T. A. (2005). Clinical significance of congenital lumbosacral malformations in young male population with prolonged low back pain. *Spine*, *30*(8), E210-E213.
10. Oğuz, H., Akkuş, S., Tarhan, S., Açikgözoğlu, S., & Kerman, M. (2002). Measurement of spinal canal diameters in young subjects with lumbosacral transitional vertebra. *European Spine Journal*, *11*(2), 115-118.
11. Quinlan, J. F., Duke, D., & Eustace, S. (2006). Bertolotti's syndrome: a cause of back pain in young people. *The Journal of bone and joint surgery. British volume*, *88*(9), 1183-1186.
12. Pekindil, G., Sarikaya, A., Pekindil, Y., Gültekin, A., & Kokino, S. (2004). Lumbosacral transitional vertebral articulation: evaluation by planar and SPECT bone scintigraphy. *Nuclear medicine communications*, *25*(1), 29-37.
13. Aihara, T., Takahashi, K., Ogasawara, A., Itadera, E., Ono, Y., & Moriya, H. (2005). Intervertebral disc degeneration associated with lumbosacral transitional vertebrae: a clinical and anatomical study. *The Journal of Bone and Joint Surgery. British volume*, *87*(5), 687-691.
14. Golubovsky, J. L., Colbrunn, R. W., Klatte, R. S., Nagle, T. F., Briskin, I. N., Chakravarthy, V. B., ... & Steinmetz, M. P. (2020). Development of a novel in vitro cadaveric model for analysis of biomechanics and surgical treatment of Bertolotti syndrome. *The Spine Journal*, *20*(4), 638-656.
15. Burnham, R. (2010). Radiofrequency sensory ablation as a treatment for symptomatic unilateral lumbosacral junction pseudarticulation (Bertolotti's syndrome): a case report. *Pain Medicine*, *11*(6), 853-855.
16. Santavirta, S., Tallroth, K., Ylinen, P., & Suoranta, H. (1993). Surgical treatment of Bertolotti's syndrome. *Archives of orthopaedic and trauma surgery*, *112*(2), 82-87.