

## CORRESPONDENCE



## The Success of Sinister Right-Handers in Baseball

**TO THE EDITOR:** Left-handed people possess less hemispheric lateralization than right-handers,<sup>1</sup> meaning that there is generally less differentiation between the functions of the right and left hemispheres of the brain. In a letter published in the *Journal* in 1982, McLean and Ciurczak<sup>2</sup> claimed that in baseball this lack of lateralization provides a relative advantage to batters who both throw and bat left-handed. They found an overrepresentation of left-handed batters in professional baseball, relative to lesser-skilled controls, and higher batting averages among professionals who throw left-handed and bat left-handed than among those who throw right-handed and bat left-handed or those who throw right-handed and bat right-handed (Table 1). However, our reanalysis, 35 years later, shows an oversight that could have supported a very different conclusion.

The odds ratios that we calculated on the basis of the original 1982 data confirm that professional baseball batters who throw left-handed and bat left-handed are overrepresented relative to controls (odds ratio, 2.45; 95% confidence interval [CI], 1.63 to 3.69). However, the earlier analysis missed the much greater advantage for

players who throw right-handed and bat left-handed (odds ratio, 7.60; 95% CI, 4.20 to 13.77). The benefit was even more striking when the odds ratios for becoming one of the top hitters, designated as those with a career batting average of 0.299 or higher, were compared (odds ratio, 3.88 [95% CI, 2.30 to 6.55] among players who throw left-handed and bat left-handed vs. 18.71 [95% CI, 9.73 to 36.01] among those who throw right-handed and bat left-handed), a finding supported by our newly collected data (Table 1).

The advantage of throwing right-handed and batting left-handed in becoming a professional also extends to an advantage when a player is competing in the major leagues. With data aggregated across all major-league players (from 1871 through 2016), those who throw right-handed and bat left-handed are more likely to have a career batting average of 0.299 or higher than are those who throw left-handed and bat left-handed (odds ratio, 3.46 [95% CI, 2.60 to 4.59] vs. 1.42 [95% CI, 1.03 to 1.95]). In contrast to the earlier analysis by McLean and Ciurczak, our analyses of the career batting averages of players with an average of 0.299 or higher and of players in the National Baseball Hall of Fame (Table 1) showed no significant differences between those who throw left-handed and bat left-handed and those who throw right-handed and bat left-handed ( $P=0.16$  for batting average  $\geq 0.299$  and  $P=0.12$  for Hall of Fame).

Batters who adopt a left-handed stance enjoy a range of potential benefits<sup>3</sup>: the limited experience opponents have pitching to left-handers, an increased likelihood of “off-handed” match-ups against right-handed pitchers, the direction of the bat-swing moving momentum toward first base (to which the batter already stands closer), potential asymmetries in the location of fielders

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**Table 1. Comparison of Major League Baseball Players According to Combination of Throwing Hand and Batting Stance.\***

Study and Subgroup	Throw Right, Bat Right	Throw Right, Bat Left	Throw Left, Bat Left	Throw Right, Bat Both Ways	Throw Left, Bat Right	Throw Left, Bat Both Ways
<b>McLean and Ciurczak<sup>2</sup></b>						
All recorded major-league players (N = 5663)						
Odds ratio (95% CI)	0.30 (0.23–0.38)	9.35 (5.37–16.28)	1.94 (1.37–2.74)	2.31 (1.26–4.25)	0.16 (0.09–0.29)	0.85 (0.20–3.67)
Percent of players	63.2	19.0	12.3	4.7	0.5	0.3
Players, excluding pitchers, who were active in 1980 (N = 569)						
Odds ratio (95% CI)	0.23 (0.17–0.31)	7.60 (4.20–13.77)	2.45 (1.63–3.69)	6.00 (3.13–11.51)	0.0 (NA)	1.88 (0.34–10.29)
Percent of players	56.9	16.0	15.1	11.2	0.0	0.7
Players with a career batting average of 0.299 or higher (N = 141)†						
Odds ratio (95% CI)	0.13 (0.09–0.20)	18.71 (9.73–36.01)	3.88 (2.30–6.55)	0.68 (0.15–3.11)	0.44 (0.10–1.91)	0.0 (NA)
Percent of players	43.3	31.9	22.0	1.4	1.4	0.0
<b>Our data</b>						
All recorded major-league players, 1871–2016 (N = 17,564)‡						
Odds ratio (95% CI)	0.29 (0.23–0.37)	5.33 (3.07–9.26)	2.60 (1.85–3.65)	2.77 (1.52–5.06)	1.02 (0.62–1.66)	2.74 (0.68–11.09)
Percent of players	62.6	11.8	15.9	5.5	3.2	1.0
All recorded major-league players, 1871–2016, excluding pitchers (N = 9230)‡						
Odds ratio (95% CI)	0.27 (0.21–0.34)	8.72 (5.02–15.16)	1.90 (1.35–2.69)	4.27 (2.34–7.79)	0.18 (0.10–0.31)	1.36 (0.33–5.60)
Percent of players	60.6	17.9	12.1	8.3	0.6	0.5
Players, excluding pitchers, who were active in 2015 (N = 511)						
Odds ratio (95% CI)	0.20 (0.15–0.27)	9.59 (5.30–17.35)	1.80 (1.17–2.77)	7.77 (4.07–14.84)	0.12 (0.03–0.52)	2.09 (0.38–11.46)
Percent of players	53.8	19.4	11.5	14.1	0.4	0.8
Players with a career batting average of 0.299 or higher (N = 228)§						
Odds ratio (95% CI)	0.14 (0.10–0.20)	18.43 (9.94–34.16)	3.67 (2.31–5.85)	1.06 (0.36–3.09)	0.27 (0.06–1.17)	0.0 (NA)
Percent of players	44.3	31.6	21.0	2.2	0.9	0.0
Career batting average	0.312±0.012	0.313±0.013	0.317±0.016	0.304±0.007	0.305±0.004	NA
Players in Hall of Fame with at least 1000 at-bats (N = 221)¶						
Odds ratio (95% CI)	0.22 (0.15–0.31)	9.92 (5.22–18.86)	2.08 (1.24–3.49)	4.20 (1.95–9.05)	0.56 (0.19–1.68)	3.65 (0.61–21.98)
Percent of players	55.7	19.9	13.1	8.1	1.8	1.4
Career batting average	0.268±0.050	0.307±0.025	0.288±0.060	0.256±0.050	0.206±0.051	0.229±0.076

\* Plus-minus values are means ±SD. Odds ratios (and corresponding 95% confidence intervals) were calculated as the number of professional baseball players observed for a particular combination of throwing hand and batting stance relative to the number of persons in the control group (i.e., high-school and grammar-school students; see McLean and Ciurczak<sup>2</sup> for details) observed for a particular combination. NA denotes not applicable.

† In their letter, McLean and Ciurczak referred to this group as the “Best hitters of all time,” which comprised players who had career batting averages ranging from 0.299 to 0.367. The total number of players was erroneously reported as 41 instead of 141 in Table 1 in their letter.

‡ Data were retrieved from [www.baseball-reference.com/leaders/batting\\_avg\\_career.shtml](http://www.baseball-reference.com/leaders/batting_avg_career.shtml) on July 19, 2017.

§ Data were retrieved from [www.baseball-reference.com/awards/hof\\_batting.shtml](http://www.baseball-reference.com/awards/hof_batting.shtml) on July 19, 2017. The Hall of Fame batting register includes batters and player inductees only (251 players in total).

¶ To obtain more reliable estimates of batting performances, we limited the list to players with at least 1000 at-bats (mean batting average, 0.276 among players with ≥1000 at-bats and 0.162 among players with <1000 at-bats).

and their skill level, and a possible tendency to be selected on a team to allow a more flexible strategy.<sup>4</sup> We speculate that players who throw right-handed and bat left-handed enjoy an additional biomechanical advantage, with the dominant (throwing) hand being placed further from the hitting end of the bat, providing a longer lever with which to hit the ball (potentially at the expense of bat control<sup>5</sup>). Given these sport-specific explanations, our findings argue against any advantage due to hemispheric lateralization.

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## Dabigatran Reversal with Idarucizumab

**TO THE EDITOR:** Data provided by Pollack and colleagues (Aug. 3 issue)<sup>1</sup> suggest a dissociation between the normalization of the coagulation profile and the establishment of effective hemostasis after the administration of idarucizumab in patients with uncontrolled bleeding. The median time to the cessation of bleeding was 2.5 hours among patients with nonintracranial hemorrhage. In analyses reported separately, the median time to the cessation of bleeding was 3.5 hours among patients with gastrointestinal bleeding and 4.5 hours among those with nonintracranial and nongastrointestinal bleeding.<sup>2</sup> The median time to the cessation of bleeding was 11.4 hours when intracranial hemorrhage was included in the analysis involving patients with serious bleeding.<sup>3</sup> Should clinicians rely solely on idarucizumab and hope that their patients do not die from uncontrolled hemorrhage while waiting for hemostasis to be established? A reasonable approach would be to administer blood-component therapy (e.g., prothrombin complex concentrate and activated prothrombin complex concentrate) — a bridge between the normalization of the coagulation profile and the establishment of hemostasis, according to *in vitro* and preclinical data<sup>4,5</sup> — in addition to idarucizumab. It can be reasonably argued that the establishment of effective hemostasis with blood-component and idarucizumab therapy outweighs the risk of thrombotic adverse events among patients with serious hemorrhaging. The

effectiveness and need for further blood-component and idarucizumab therapy may be assessed by serial clinical assessments and a serial profile of clotting times.

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**TO THE EDITOR:** In 2015, an interim analysis involving 51 patients with acute bleeding who had